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FACTORS INFLUENCING THE SOILING OF ACETATE CARPETS

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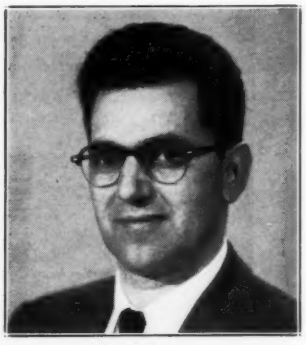


Fred Fortess

The most important single factor influencing the soiling of acetate carpets is mineral oil bonding. The lubricant on the original staple or the oily matter picked up during processing and held on the pile, binds soil particles to the carpet surface. A critical study of the carpet manufacturing process reveals that the use of petroleum or fatty carding oils, as well as the use of oily jute for the backing, is detrimental to the soiling characteristics of the carpet. Residual scouring agents and dyebath assistants are generally innocuous. Certain waxy lubricants can be successfully substituted for carding oils and these materials successfully block the effect of jute oil, while not increasing the soiling by other mechanisms. The mechanism of jute oil migration to the pile is that of capillary wicking. Soil-resistant acetate carpets may be made by using low applications of a scourable staple lubricant, a waxy, nonsoiling carding oil substitute, and low oil jute for backing.

INTRODUCTION

RELATIVELY little work has been published about the factors which cause carpets to retain soil after floor wear. The New York Section, AATCC has summarized the past work in this field (*1*). Compton and Hart (*2*) have more recently reported the effect of grease as a soil bonding agent in the study of grease-carbon soiling of cotton fiber systems. Test methods in the past have been limited for the most part to actual floor wear experiments on small portions of sample carpets and to the Masland laboratory soilage test (*3*), which grinds vacuum cleaner dirt into carpet-pile-yarn cuttings by means of a ball-mill. In evaluating the degree of soiling (by the latter method), the cuttings are scoured with a detergent and a rather exacting particle count is done on an aliquot of the detergent bath.

A paper by the New York Section, AATCC (*1*) brought out clearly that the most probable mechanisms for the travel of soil to a carpet face were 1) direct transfer from shoes, 2) deposition from the air, and 3) attraction by static electricity, while the mechanisms of soil retention to the face were 1) mechanical occlusion in the striations and rugosities of the fiber, 2) oil bonding, and 3) static electricity.

While these factors and perhaps others combine to explain the soilage picture, probably the most dramatic cause for soil retention is the presence of oily substances attached to the pile fiber. The standard carpet manufacturing process results in oil on the carpet surface. Fiber producers, carpet companies and jute yarn suppliers are all involved. It is the intention of the authors to herein describe, in a critical fashion, the production of a typical acetate axminster carpet and to determine the points of introduction of oily material to the pile fiber. Before proceeding, it would be desirable, however, to consider a) the nature of carpet soil and b) a typical manufacturing process for the production of an axminster carpet.

Charles E Kip

CARPET SOIL——Studies made by the Hoover Vacuum Cleaner Company (*4*) on vacuum cleaner dirt collected from many cities in this country produced data on average particle size distribution as shown in Table I.

Also from the average of chemical analyses of samples from 6 cities, the probable ultimate composition of carpet dirt was calculated as shown in Table II.

TABLE I
PARTICLE SIZE DISTRIBUTION OF VACUUM CLEANER DIRT. AVERAGE OF 16 LARGE CITIES THROUGHOUT THE COUNTRY

Sieve Mesh	*Percent Remaining on Sieve*
20	6
100	22.5
280	57.5
Pan	14

TABLE II
CALCULATED ULTIMATE COMPOSITION

Constituent	*Percent*
moisture	3
sand, clay, quartz, feldspar	45
limestone, dolomite	5
gypsum, apatite	5
animal fibers	12
cellulose materials	12
resins, gums, starches	10
fats, oils, rubber, tar	6
undetermined	2

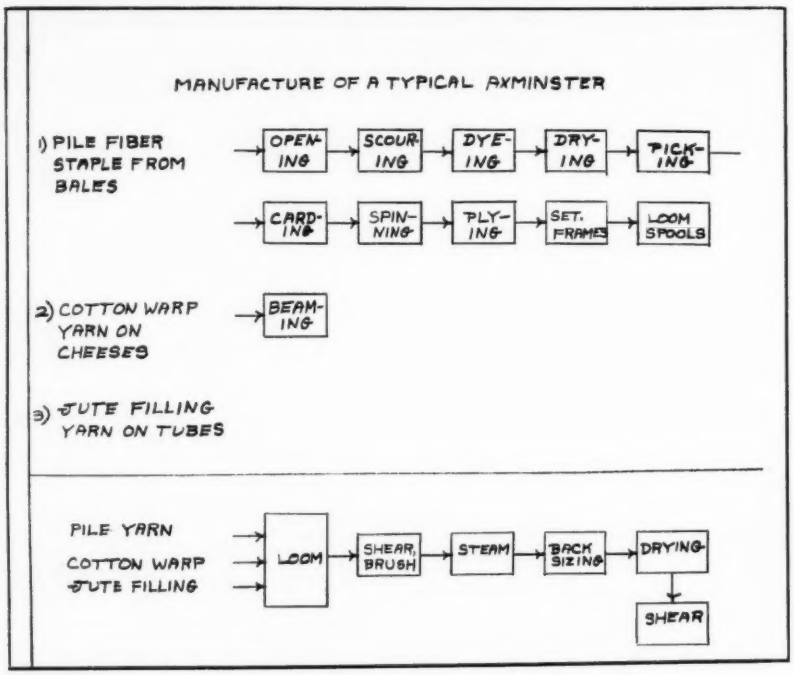


Figure 1
Schematic flow sheet of typical acetate axminster manufacture

Unfinished acetate

Acetate plus 1.3% paraffinic wax

Figure 2
Laboratory soilage test.
Soiled yarn mats of unfinished and paraffinic wax-treated acetate carpet yarn.

Thus, we are faced with a very fine mixture consisting, in general, of over 50% sandy and clay-like material, which is found to cling rather tenaciously to oily substances.

TYPICAL MANUFACTURING PROCESS FOR AXMINSTER CARPETS—— Since many references will be made to the manufacturing process of carpets, and in particular to the process for acetate axminsters, a brief summary of the operation is given. The presentation is schematic (see Figure 1) and emphasizes the points at which oil enters the system. Description of the machinery is outside the scope of this paper. This procedure does not apply in all cases, but could be considered typical. Pile fiber arrives at the plant in the form of staple. Here is the first important source of oily matter, since virtually all fibers arrive with their primary processing lubricant applied to the fiber surfaces. Following the opening operation, the staple or stock can be scoured using a built detergent. Scouring does not, in general, remove the lubricant entirely since many primary lubricants contain a high percentage of mineral oil. The stock-dyeing operation provides another possible entry point for undesirable fatty groups into the system in the form of dyeing assistants. After drying, the stock is sent to the picker, a very critical operation as far as the introduction of oil is concerned. Most carpet companies have in the past sprayed water-oil emulsions on the staple at the picker in order to provide lubricity and antistatic properties subsequent to the carding operation. During the carding, spinning, plying, setting and loom spooling operations, contamination by machine is always a possibility and the effect of the latter on soiling of the final carpet is known.

Cotton warp yarns usually arrive at the plant on cheeses, and during the ensuing slashing and beaming operations the danger of oil contamination is not great.

Jute yarn (for the carpet backing) arrives on tubes and may contain 6% or more processing lubricant. Since the lubricants are largely petroleum, considerable oil can be introduced into the process from this source. Following the scheme of Figure 1, pile yarn, cotton warp, and jute filling are brought together at the loom to produce the carpet. After a preliminary shearing and brushing, the carpet usually undergoes a steaming operation. Steam is blown through the backing and the combination of heat, moisture, and mechanical action produce the desired effect of an erect, more attractive pile. The remainder of the process includes backsizing, drying, and final shearing.

EXPERIMENTAL

MATERIALS——The carpet pile or face yarns were, in all cases, 2/54's, the acetate yarns being of 4-inch, 17 dpf Celanese staple. The latter was supplied 1) with no oil, 2) lubricated with about 2.50% of an incompletely scourable lubricant, and 3) with about .3-.5% of a scourable antistatic lubricant. Jute was obtained from several of the leading producers and was supplied as either regular (containing about 6% lubricant), dry cleaned, or low oil, which might contain about 1% of oil. Carpet samples were identically constructed in a regular 7-row-per-inch axminster with ¾ inch pile.

Materials used in the trials included a variety of commercial scour-bath components, dyeing assistants, carding oils, machine oils, and anionic and cationic finishing agents. These are listed in the Appendix.

METHODS——

(a) *Floor Trials.* The floor trials were conducted in a corridor equipped with wooden guides for the purpose of keeping traffic on the carpets. A photoelectric counting device was used and the average daily number of persons involved was about 1200. Photographs were usually taken after one and six days of floor soilage. Evaluation of soiling was visual, or was done by reflectance measurement using either the Hunter Hazemeter or a No. 610A Photovolt Meter.

(b) *Laboratory Soilage Test.* In some instances it was desirable to work on the yarn itself and a laboratory soilage test was developed for quick screening of finished and unfinished yarns. Masland (3)

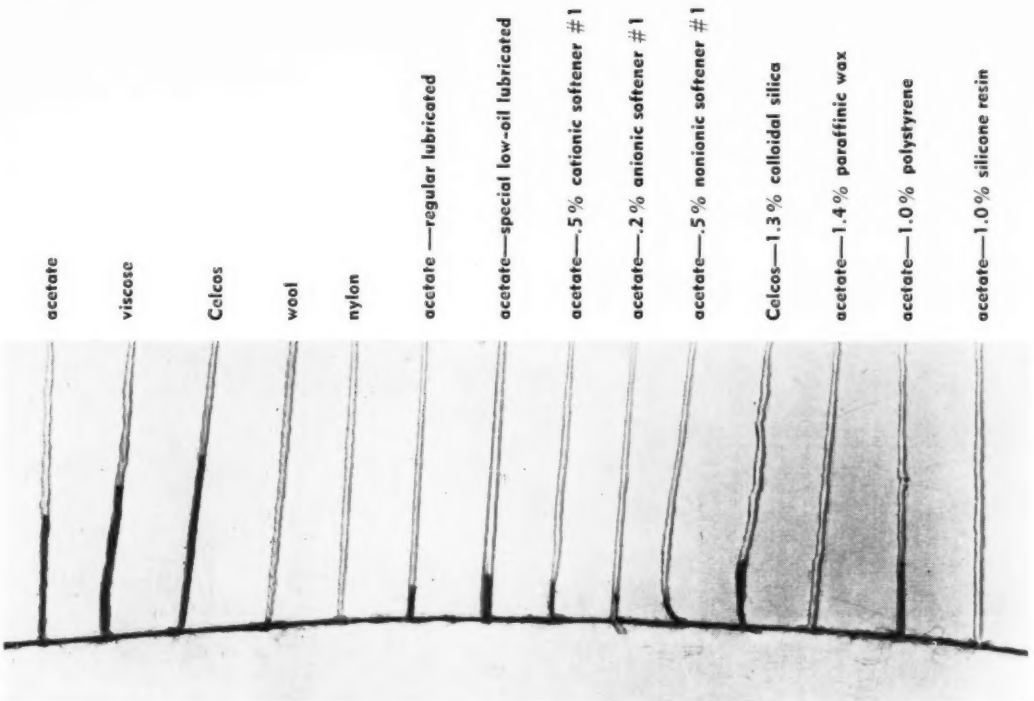


Figure 3
Arrangement for studying the wicking characteristics of carpet yarns.

has described a method utilizing vacuum-cleaner dirt, which is ground into yarn cuttings in a ball-mill. After the excess dirt is blown away, the soiled yarn is scoured and a particle count is made on an aliquot of the scouring bath. Since this was too exacting and time consuming for our purpose, we used a test similar to Masland's in that ball-milling with vacuum cleaner soil was employed although different fiber-dirt ratios were utilized. The method of evaluation of the extent of soiling differs from Masland's method. A definite weight of soiled-yarn cuttings is confined in a standard bottle screw cap, covered with a glass, and reflectance measurements are made on this yarn mat by a reflectance meter. Figure 2 shows a comparison of yarn mats of unfinished acetate and acetate finished with paraffinic wax. In this case, the two reflectance readings are 33 and 24, respectively. Details of the method are given in the Appendix. Table III shows the reproducibility of the test. It must be realized that correlation attempts with floor trials can only be made with great discretion, since the jute oil in the carpet backing can migrate to the pile, where it can contribute to soiling. Conversely, if oil-free jute is used, oil from the pile can migrate back to the jute.

(c) *Wicking Studies.* In studying the ways that jute oil could migrate to the pile surface, a test was needed to determine the relative mineral oil wicking tendencies of various carpet yarns. Using a modification of the method utilized by one of the large jute yarn manufacturers in studying migration (5), dry-cleaned jute-backing yarn was lubricated with a low viscosity mineral oil in which was dissolved .2-.4% Calco Gas Red. The procedure consisted of stretching this treated yarn horizontally and then tying a one-foot length of carpet pile yarn with a simple knot. The pile yarn pieces were extended upward vertically and secured to an additional horizontal line in the manner shown in Figure 3. Measurements of the extent of upward flow of red-tinted oil were taken at 3 hours, 1 day, and four days.

In the same manner, reverse wicking was observed. In this case, the vertical carpet yarn had been lubricated with tinted mineral oil while dry-cleaned jute was used in the horizontal. Measurements of the extent of tint flow were made along the dry-cleaned jute from the point of juncture with the carpet yarn. In one study, an ether-extracted acetate carpet yarn, lubricated with about 5% of Textolene B-50 mineral oil tinted with the red dyestuff, showed about a half-inch of red-oil migration into the dry-cleaned jute after one hour at room temperature. After 48 hours, a measurement of about 2½ inches was observed in both directions from both top and bottom junctures.

As far as laboratory work is concerned, therefore, it is felt that both ball-mill soilage anud wicking tests must be considered before an adequate judgment can be made in screening finished and unfinished carpet yarns. Ideally, a technique for measuring electrostatic properties of yarns and finishes should be included.

(d) *Miscellaneous Methods.* The following procedures were also utilized in this study:

(i) *Laboratory dry cleaning of carpets*: This involves immersing and moving a sample in a suitably large quantity of Stoddard solvent for ten minutes, draining, using fresh Stoddard solvent twice more, and finally treating in ethyl ether. After air drying, any remaining solvent is removed by

TABLE III
REPRODUCIBILITY OF THE LABORATORY SOILAGE TEST

Sample (soiled)	*Reflectance readings*	*Average*
#1 acetate scoured	30.7, 30.7, 30.9, 30.9, 31.2	30.9
#2 acetate scoured	30.9, 30.5, 31.4, 31.4, 30.9	31.0
#1 acetate unscoured	27.6, 28.1, 28.1, 28.6, 27.9	28.1
#2 acetate unscoured	27.6, 28.1, 28.1, 27.4, 27.9	27.8

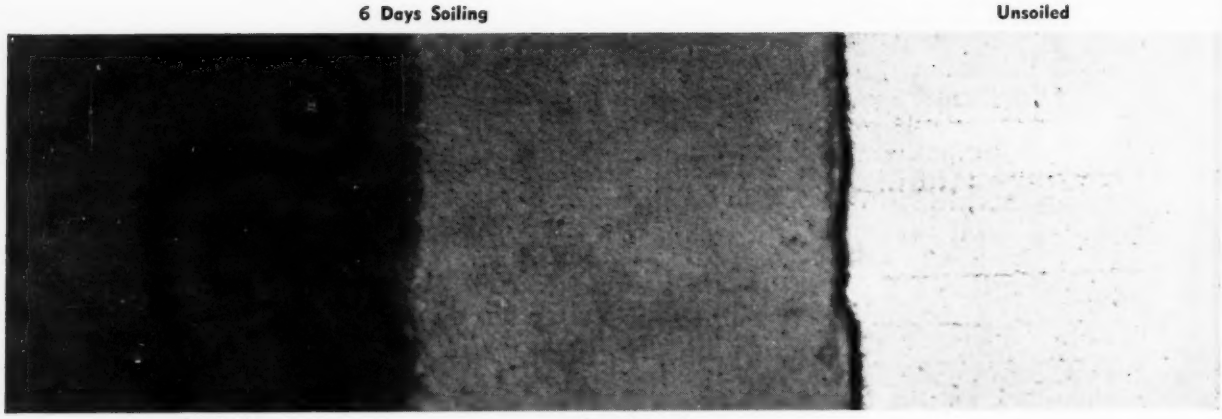


Figure 4
Principle of carpet manufacturing process as cause of soiling.

heating in the oven.

(ii) *Dipping samples in weak detergent solutions:* Following a 5-minute immersion in .2% of detergent solutions, all pieces are squeezed through a hand wringer to remove excess liquid. The sample is dried without removing the residual detergent.

(iii) *Spraying of oils:* 1% of oil emulsions and 1% of resin dispersions are made up and sprayed on the carpet surface with a hand spray.

RESULTS AND DISCUSSION

PRINCIPLE OF CARPET MANUFACTURING PROCESS AS CAUSE OF SOILING —— Examination of the carpet samples in Figure 4 should establish the fact that there are aspects in the manufacture of carpets (in this case acetate axminsters) which play an important role in the soiling phenomenon. At the left is a 7-row acetate axminster prepared in the regular way from staple supplied with ordinary primary finish, and from jute with its ordinary lubricant. It had been floor soiled for 6 days by a daily average traffic of about 1200 people. In contrast, the sample in the center is the same carpet which had been dry-cleaned before soiling. Intrinsically, the acetate fiber stands up rather well to soiling while that portion that had accumulated oily matter in its manufacture picks up and retains considerable soil. To check the effect on other fibers, carpets of identical construction were woven of wool, viscose, acetate, nylon, Celcos, dynel, and cuprammonium rayon. Results are shown in Table IV.

Reflectance figures show that wool and nylon are practically unaffected by predry-cleaning, while acetate and viscose, and to some extent dynel, are much improved by this treatment. Celcos was not available in its usual "as received" state at the time of this test, while the cuprammonium sample was a pigmented green fiber which could not readily be studied. Table V shows a laboratory evaluation of some of these same carpet yarns prior to their being woven into a carpet.

For example, an unscoured acetate yarn was found to have 2.43% of ethyl ether extractable matter and to give a laboratory soiled reflectance value of 27. The same yarn, after a mill scouring and simulated dyeing, was found to contain over 0.5 percent of ether extractables but the reflectance had been raised to 32. Hence, the principle of surface oily matter can be checked in the laboratory. Dynel also experienced an increase in reflectance from 26 to 29. Nylon and viscose showed only a slight improvement, while wool, as in the floor trial, was unchanged. Since the complete manufacturing process can result in an accumulation of solvent-removable matter, which adversely affects the soiling of the final carpet, a critical breakdown of the process has been made in order to isolate the cause of the oily matter and to make recommendations for removing or blocking the sources.

PRINCIPLE OF PRIMARY YARN LUBRICANT AS CONTRIBUTING TO SOILING——The first point of consideration in our schematic-process flow sheet is the staple as received from the fiber producer. The Celanese Corporation has contributed to the solution of the soiling problem by supplying staple with a special low application of an antistatic scourable lubricant. Table VI shows the laboratory soiling results of three different acetate yarns containing no oil, the special low percent finish, and the regular lubricant.

Thus, where the regular lubricated acetate (2.23% total ether extractables) gave a reflectance of 26.5, the unlubricated yarn showed 30. Special low-oil acetate, as might be expected, gave an intermediate value of 27.5-28. Floor trials of carpets woven of the three differently lubricated fibers, showed even more promising re-

TABLE IV
EFFECT OF PREDRY-CLEANING ON FLOOR SOILING PROPERTIES OF CARPETS OF SEVEN DIFFERENT FIBERS
(All figures represent percent whiteness as determined on the Hunter Hazemeter)

	wool	*viscose*	*acetate*	*nylon*	*Celcos**	*dynel*	*cuprammonium*
original, unsoiled	49.5	55	57	38	58	34	17
original, soiled	36	22	16	21	34	21	20
predry-cleaned, soiled	36	33	34	23	31	26	18

* Celcos available only in the scoured condition.

TABLE V
LABORATORY SOILAGE RESULTS AND ETHER EXTRACTABLES ON MILL SCOURED AND UNSCOURED CARPET YARNS

	Unscoured		*Scoured and Simulated Dyed*	
Yarn	*Reflectance of Soiled Sample*	*Ether Extractables* %	*Reflectance of Soiled Sample*	*Ether Extractables* %
acetate	27	2.43	32	.53
viscose	26	1.82	27	.14
wool	31	2.46	31	1.07
nylon	31	1.88	32	.20
dynel	26	5.56	29	.90

sults. According to Table VII, when regular jute backing is used, the carpet made of regular acetate gave 13.7% absolute reflectivity by the Photovolt meter. Unlubricated acetate showed 18.0, while the special low-oil lubricated displayed improvement over and above the no-oil.

While apparently anomalous, this phenomenon will be explained later when the interaction of jute oil is reported.

EFFECT OF SCOUR BATH & DYEBATH COMPONENTS ON SOILING OF THE FINAL CARPET——The second step of the production scheme is scouring of the staple. From the results to date, it can be stated in general that residual scouring and dyebath assistants do not seriously affect the ultimate soiling properties of the carpet. The samples of acetate carpet on the left in Figure 5 had been immersed in .2% of the various surfactants, squeezed through rollers, and dried. While it is not likely that detergents from the scouring operation would remain with the fiber during dyeing, surfactants of all types are very often used as dyeing assistants and, therefore, should be considered for their role in the soiling picture. Leonard (6) has shown that soap residues on wool react with the acid pile to form free fatty acids, which contribute to soiling. No such reaction should occur with acetate, which is very nearly neutral. It was also pointed out that detergents whose physical form was liquid such as the nonionic polyethyleneoxide ethers and the alcohol sulfates would be conducive to soiling because of the sticky nature of the residue. Figure 5 shows the results after one day of floor soiling. Only the left side of the array is concerned with detergents and dyeing assistants. While the general level of soiling is low, the worst offender is the nonionic ether which here is probably showing its inherent sticky nature. After 6 days of soiling, differential soiling is not as noticeable as after 1 day and, therefore, 1-day soiling results are preferred in this case.

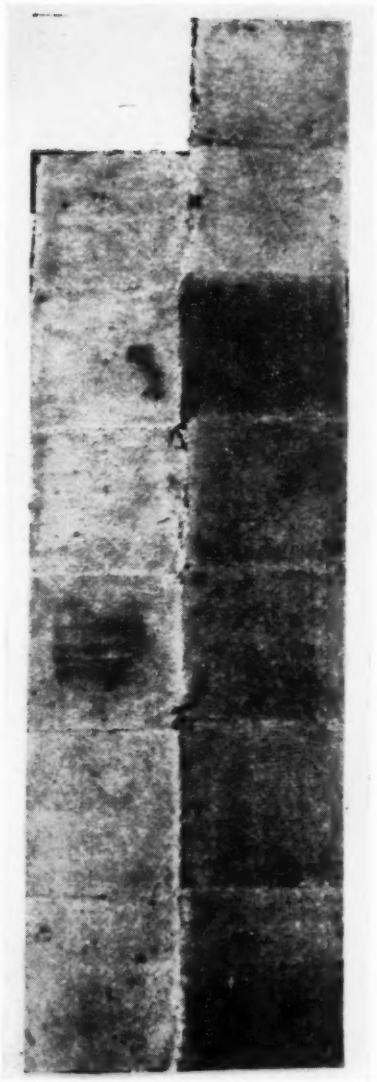


Figure 5
Effect of scouring agents, dyeing assistants, carding oils, and machine oil on soiling of acetate carpets.

CONTRIBUTION OF CARDING AND MACHINE OILS TO SOILING——One common source of oil in the carpet manufacturing process is the material used for the carding and spinning aids. Very often, oil emulsions are sprayed on just prior to the picking operation. Picking then mixes the oil and the fiber more or less uniformly. These oils give lubricity and cohesion to the fibers in the carding and spinning processes, and are usually derived from petroleum, e g, wool oils #1, 2, and 3 (see Fig 5). Animal oil, such as lard oil, can also be used here. After one day, considerable soiling is noticeable on the samples sprayed with wool oils #1, 2, and 3, and lard oil. It was noted that after two or three days the extent of soiling on these pieces was greater than at the end of six days. As time goes on, oil is progressively removed with soil by vacuuming or else migrates to the oil-free jute used in this case. However, the initial soil-

TABLE VI
EFFECT OF PRIMARY LUBRICANT ON ANALYSIS AND LABORATORY SOILING OF ACETATE CARPET YARNS

Sample	*Petroleum ether extractables* %	*Ethyl ether extractables* %	*Water extractables* %	*Reflectance of soiled sample*
Regular Lubricated	1.75	.48	.08	26.5 - 26.5
Unlubricated	.07	.08	.07	30 - 30
Special Low Oil Lub	.44	.17	.01	28 - 27.5

TABLE VII
EFFECT OF PRIMARY LUBRICANT ON SOILING OF ACETATE CARPETS BY FLOOR TRIAL
(Photovolt readings—absolute reflectivity)

Type of Acetate Used	*Average Reflectivity After 6 Days Soiling*
regular lubricated	13.7
unlubricated	18.0
special low-oil lubricated (regular jute backing)	22.5

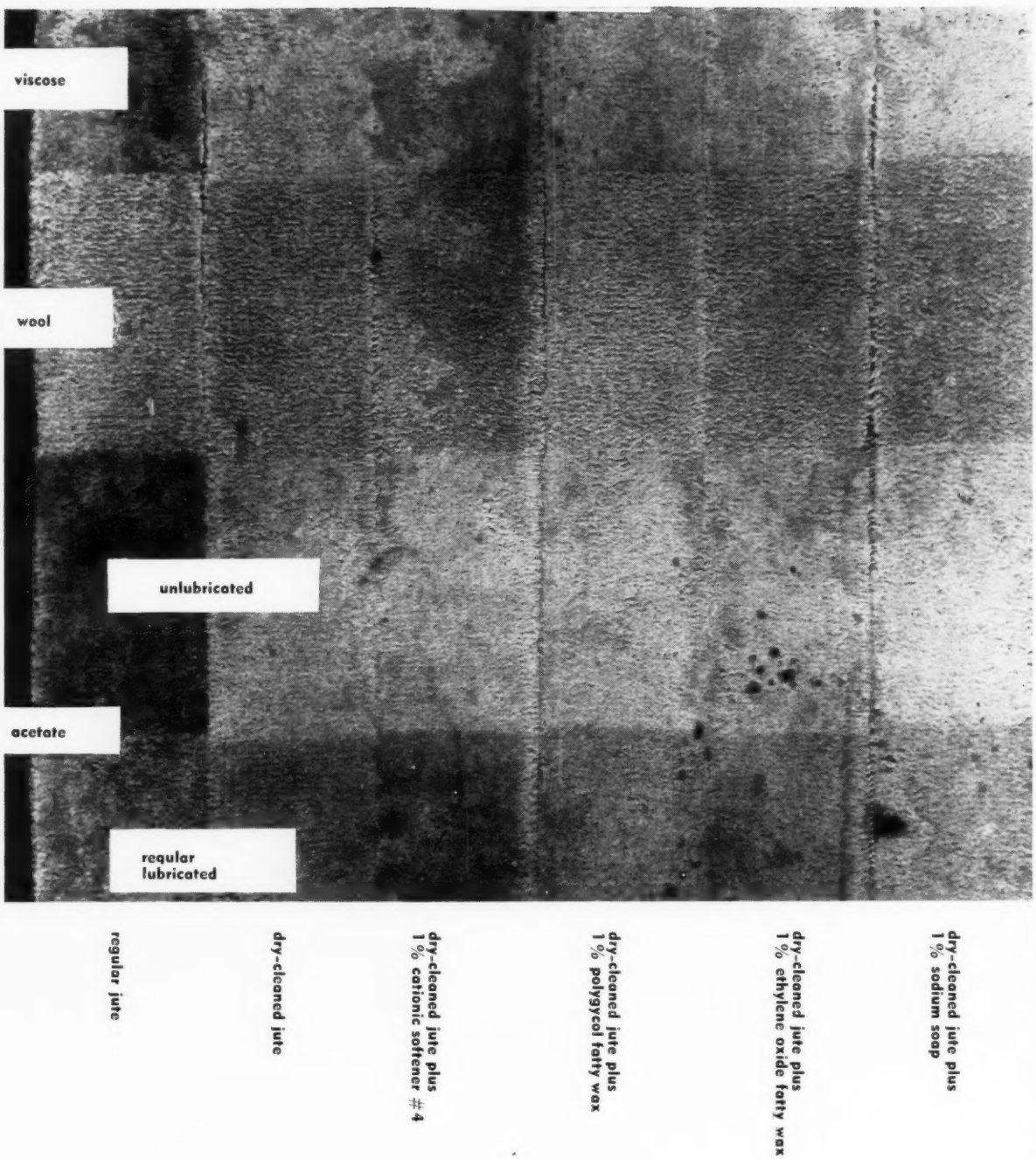


Figure 6
Effect of relubricated jute on carpet soiling.

ing is very important from a sales point of view. From Figure 5 (top) it can be seen that two experimental carding aids, cationic softener #1 and anionic softener #1 (antistatic waxy softeners) were satisfactory for carding and spinning and contributed very good soil-resistant characteristics to the acetate carpet. These will be discussed in detail later.

The effect of machine oil, as exemplified by Vactra, may also be seen in Figure 5. The worst soiling of any of the oils is in evidence here and shows the importance of taking strict precautions to keep machinery oil away from the pile fiber at all times.

CONTRIBUTION OF JUTE OIL TO SOILING——One of the greatest factors in soiling of the final carpet is the lubricant used in the manufacture of the jute yarn. In an axminster, jute is used unsized as the filling yarn. It has been established that those carpets made of acetate and

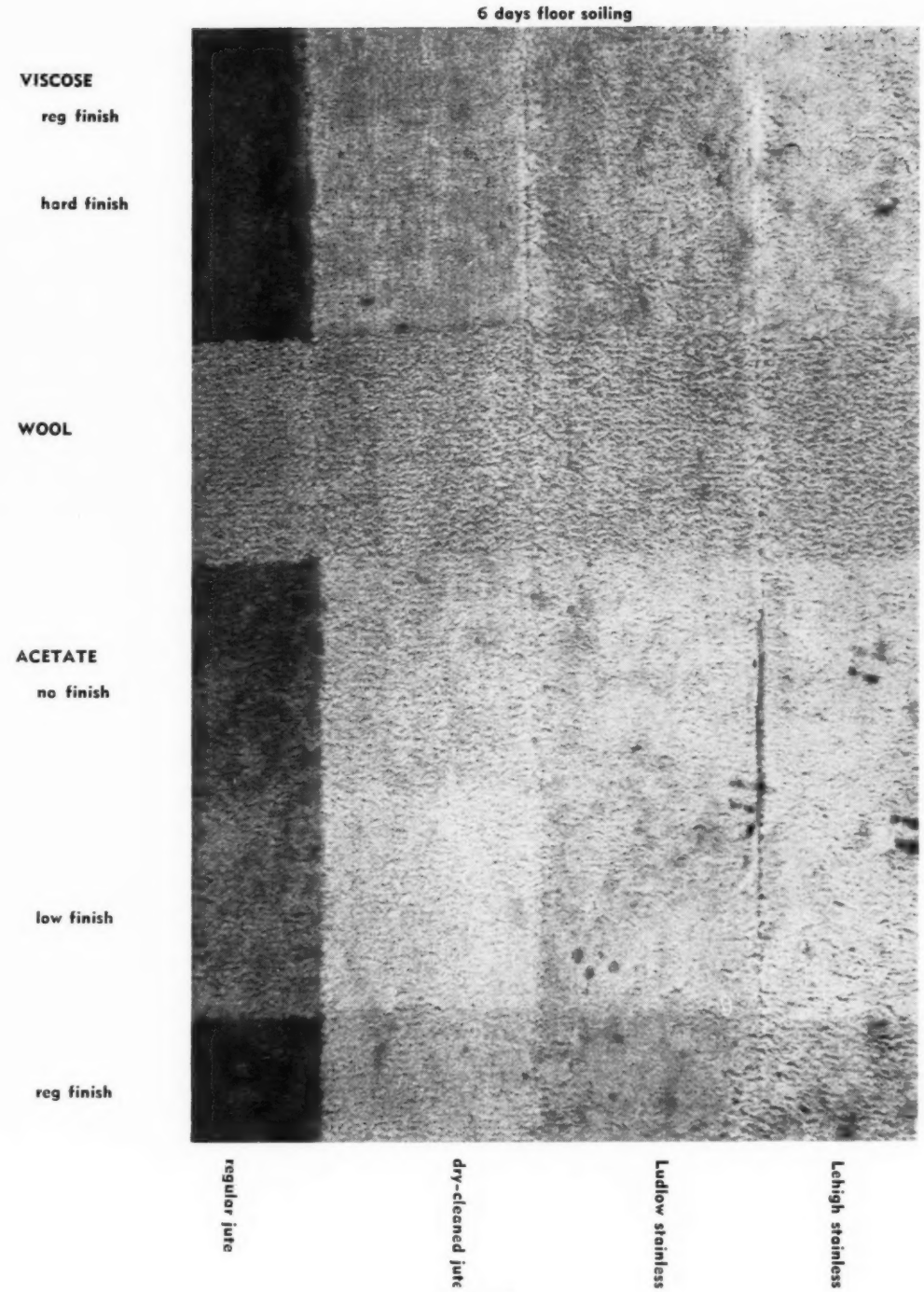
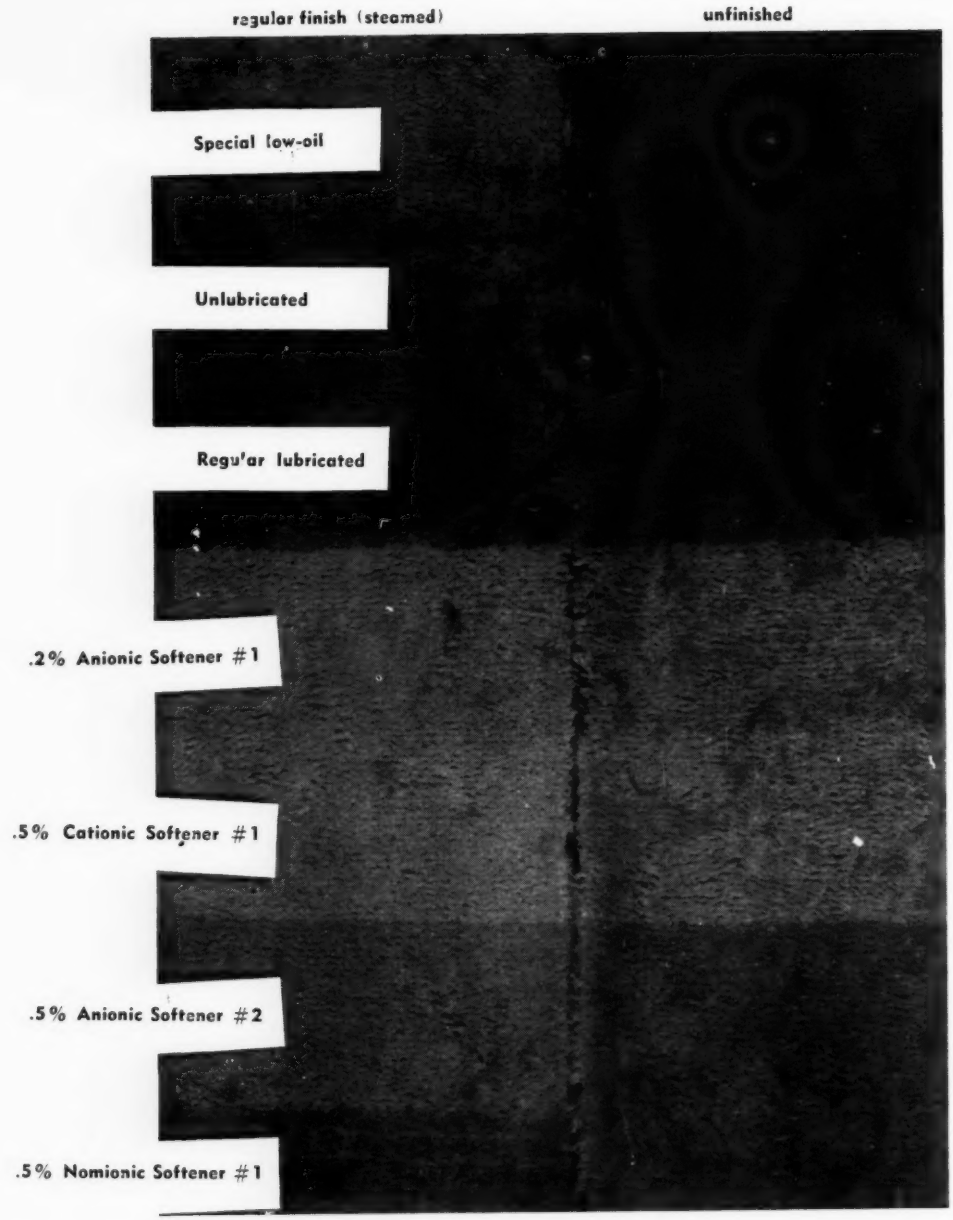


Figure 7
Effect of jute oil content on carpet soiling.

viscose in the pile and oily jute in the backing soil to a greater degree than those made with dry-cleaned jute or low-oil jute. Very little, if any, difference is noticed on the wool carpets. Figures 6 and 7 show dramatic differences in soiling of the final carpets using regular and dry-cleaned jute. Since jute manufacturing requires a lubricant for proper processing, it was suggested that various soapy and waxy lubricants be used in place of the usual petroleum oil material. Consequently, dry-cleaned jute was treated in 1% of water solutions (solids basis) or dispersions of sodium soap, ethylene oxide fatty wax, polyglycol fatty wax, and cationic softener #4. Figure 6 shows the floor trials on carpets woven with these jutes. All trial samples with the possible exception of cationic softener #4 reduced the soiling to the level of dry-cleaned jute. These results indicated that if jute could be successfully processed using one of these substitute materials and other waxy mate-



6 days floor soiling
Figure 8
Effect of waxy lubricants on pile yarn of regular jute acetate
Axminsters as to soiling resistance.

rials as lubricant, a major contribution to the soiling problem could be expected. Notable improvement was obtained in all cases on regular and no-oil acetate and regular viscose. Not much change occurred in the wool.

The jute producers also have been actively engaged in this problem and have come up with a low-oil or stainless jute that can be processed fairly successfully without adding to the soiling problem. Figure 7 shows evidence that two low-oil jutes reduce the level of soiling down to that of the dry-cleaned jute piece. Regular, low-oil, and no-oil acetate, and regular and hard-finish viscose are greatly aided; wool is again relatively unaffected. Analyses of the jutes are as follows:

jute type	*ether extractables* %	*water extractables* %
Regular	9 - 12	—
Dry Cleaned	.17 - .29	.63 - .80
Low Oil #1	.70	.46
Low Oil #2	1.20	.42

MECHANISM OF JUTE OIL MIGRATION——Frequent mention has already been made of oil migration from jute to the carpet surface. The most likely mechanism of transfer was first thought to be the steaming operation, which occurs in the process just preceding backsizing. It is at this point that relatively high-pressure steam is shot through the carpet from underneath. It seemed logical to assume that the oily lubricants were either steam distilled or mechanically entrained by the

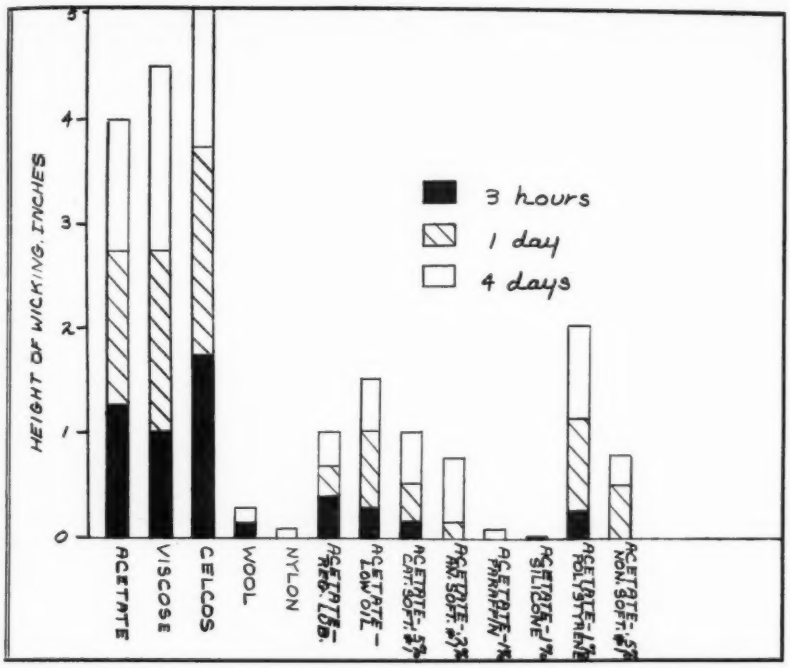


Figure 9
Mineral oil wicking characteristics of various carpet yarns.

blast of steam. However, in a visit to one of the jute mills (5) it was vividly pointed out that a wicking action was actually taking place. They were able to show this by braiding various carpet yarns with jute containing a red-tinted oil. After remaining in contact for a while, even at room temperature, the red color could be seen in the carpet yarn. To settle the question of the effect of steaming, a trial was made to evaluate soilage of acetate carpets steamed and unsteamed. Figure 8 shows the results. In all cases, whether the acetate carpet pile has no oil, regular finish or waxy carding oil substitutes, steaming improves the soiling characteristics. Hence, jute oil migration by steaming does not occur and one is forced to consider seriously the wicking hypothesis. Why the steaming operation improves soiling is not clear, but it may be that excess oil is steamed off the face.

Figure 9 shows that oil-free acetate, viscose, and Celcos readily receive mineral oil by a wicking action from lubricated jute. Wicking could occur 1) in the longitudinal grooves of the aforementioned fibers by capillary action, 2) in the spaces between neighboring filaments, or 3) wetting of the surface of the fibers and consequent spreading out of the oil in a thin film. In all probability the third mechanism is taking place.

It is noted that both the regular and special low-oil lubricated acetate carpet yarns cut down mineral oil wicking considerably. We can now explain the apparently anomalous results shown in Table VII as follows: The special low oil lubricant reduces considerably the extent of wicking of jute oil and yet contributes little per se to soiling by virtue of its low application. The regular Celanese lubricant curtails jute-oil migration also, but the high application causes severe soiling. The pile made of no-oil yarn is unprotected from wicking of the jute oil but is not contaminated with any surface oil of its own so that intermediate soiling results.

The .5% cationic softener #1 and .2% anionic softener #1 treatments are seen to protect the acetate pile from oily jute to a considerable extent. It will be noted from Figure 5 that neither of these materials of themselves cause soiling of the final carpet. In addition, due to antiwicking action, these proprietary compositions would be expected to act as soil-resistant finishes for the carpet. It will be seen in the next section that this is actually the case. Although the paraffinic wax did not allow wicking of mineral oil, we have noticed, both in the laboratory and on floor tests, that this material in itself causes severe soiling. One probable explanation is that electrostatic forces, which could build up on this nonionic paraffin wax, retain the soil. When higher viscosity mineral oil is used, some reversal in results is noticeable so that a definitive explanation of wetting by mineral oil is not possible.

Celcos, a partly regenerated-acetate fiber, behaves in a manner similar to acetate. Figure 10 shows the extent to which mineral oil wicking may be diminished by the use of certain finishing agents. Cationic

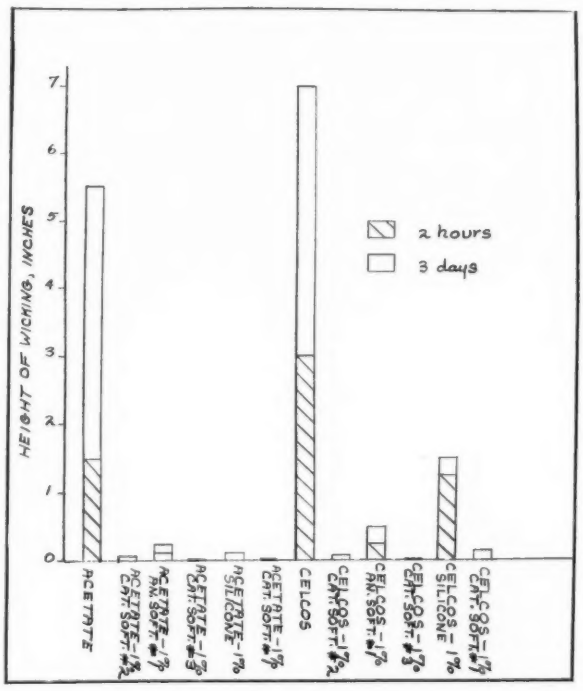


Figure 10
Mineral oil wicking characteristics of acetate and Celcos carpet yarns.

softener #3 gives excellent results on both Celcos and acetate.

The subject of reverse wicking was studied because it was discovered that on floor soiling, fresh samples of low-oil jute-acetate carpets could be differentiated as to the type of lubricant on the staple whereas old samples of the same carpets showed little, if any, difference. The hypothesis suggested that wicking was working in reverse, i e, oil was now migrating from the pile to the jute. To test this, an experiment was made in which a vertical acetate carpet yarn lubricated with a tinted dye was tied to a horizontal length of dry-cleaned jute. Results showed that after three hours, red coloration had extended one inch along the jute in both directions from the knot. After three days, the coloration had spread to a length of three inches. It seems probable, therefore, that the principle of reverse wicking is a practical one and suggests that the use of very low-oil jute should safeguard the carpet pile from an excess of foreign oil.

PRINCIPLE OF PROTECTING THE PILE FROM JUTE OIL MIGRATION ——At this point, it is evident that compositions can be applied to the pile yarn to prevent oil migration from below while avoiding soiling by other mechanisms (such as oil-bonding and electrostatic forces). Two of these proprietary materials have been mentioned before, cationic softener #1 and anionic softener #1. There are many other suitable materials that are satisfactory but these two will exemplify the principle. Figure 8 shows regular jute-acetate carpets. The pile yarns have been treated in staple form with waxy lubricants. After six days of floor wear, marked improvement in soiling properties is noticeable when anionic softener #1 and cationic softener #1 are used. Figure 11 shows the results after six days of floor wear on samples identical to those in Figure 8 except that low-oil jute has been used in the backing. The great importance of jute-oil content is evident here. Only the strip containing the high-oil-lubricated acetate staple shows severe soiling. The cationic softener #1, anionic softener #1, no-oil, and special low oil (antistatic) acetates all have about the same level of soiling. The advantages of using the above softeners (or other similar acting materials) in this case are: 1) they are efficient carding aids, and 2) they would protect the pile in the event that jute containing a relatively high quantity of oil was inadvertently used.

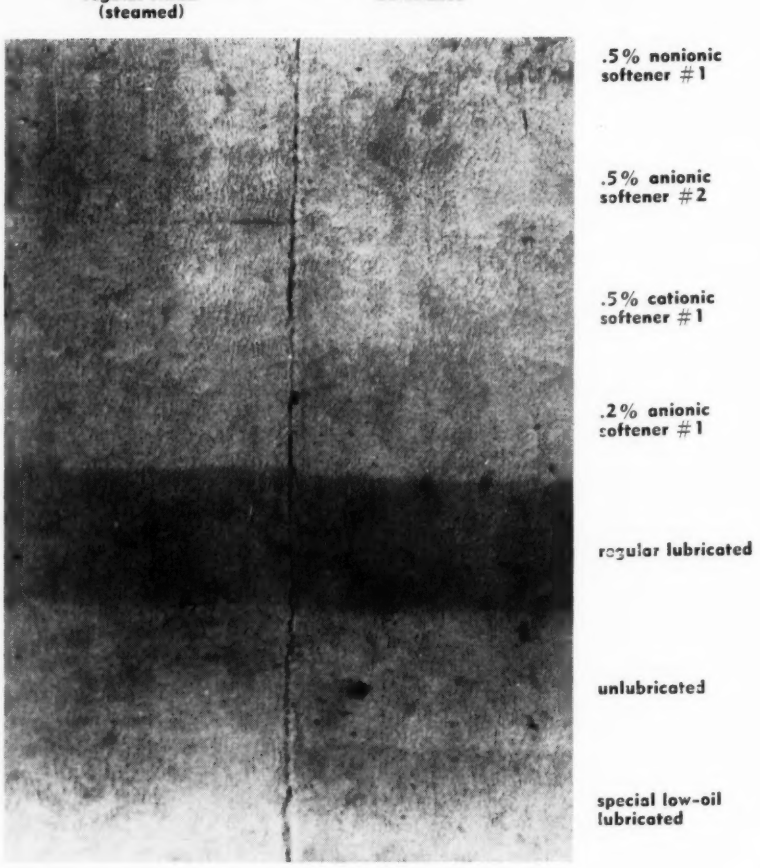


Figure 11
Effect of waxy lubricants on pile yarn of low-oil jute acetate Axminsters as to soiling resistance.

SUMMARY

It has been shown that one of the most dramatic causes of carpet soilage is the presence of oily subsances that are attached to the pile fiber in the carpet manufacturing process. Soil then adheres to the oily substance. The manufacture of a typical acetate axminster is briefly described and each stage of the process is critically examined for possible contribution of oily substances to the fiber. Thus, whereas the clean acetate fiber is intrinsically soil resistant, it is shown that:

a) The primary staple lubricant may contribute to soiling. Improvement is noted when the quantity of lubricant is reduced.

b) Scouring and dyebath assistants are, in general, innocuous.

c) The usual carding and spinning oils may cause severe soiling. The use of certain antistatic waxes results in outstanding improvement in soiling of the final carpet.

d) Textile machinery oil can cause spotty soiling.

e) Oil in the jute backing has been found to migrate by wicking to the acetate pile surface and cause serious soiling. The jute oil can be successfully blocked by certain waxy lubricants or low oil jute can be conveniently employed. Celcos behaves in a manner similar to acetate in this respect.

To obtain an acetate carpet of greatly improved soil resistance, the main points to consider are: 1) a low level of primary lubricant on the staple, 2) the use of certain nonsoiling antistatic waxes applied at the picker prior to carding, and 3) the use of low-oil jute in the backing.

ACKNOWLEDGMENT

The authors wish to acknowledge the cooperation of the Firth Carpet Company in all phases of yarn and carpet manufacture, which resulted in the isolation of those factors influencing the soilage of carpets. The Ludlow Mfg & Sales Company suggested wicking action as the mechanism of jute-oil migration to the carpet face. The

Hoover Vacuum Cleaning Company provided the data on the composition of carpet soil.

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APPENDIX

CHEMICAL SPECIALTIES USED——A list of the chemical specialties used in this work is as follows:

1) *Carding and Machine Oils:*

lard oil, Welch, Holme and Clark Company
Proxol T, Procter & Gamble
Sulfol 448, E F Houghton
Sunotex, Sun Oil Co
Vactra, heavy machine oil, Socony-Vacuum

2) *Finishing Agents:*
Ahcovel A, Arnold, Hoffman
Ahcovel R, Arnold, Hoffman
Avcosol 104, Atlas Powder Company
Carbowax 400 Monostearate, Glyco Products
Ceranine CEL, Sandoz
Ceremul M, Socony-Vacuum
DeCetex 104, Dow Corning
Merlon S, Monsanto
Profine, Proctor and Gamble
Sapamine WL, Ciba
Soromine BSA, General Dyestuff
Tween 61, Atlas Powder

3) *Scouring Agents and Dyeing Assistants:*
Amber Soap Flakes, Proctor and Gamble
Duponol G, Du Pont
Nacconol NR, National Aniline
Igepal CA, General Dyestuff
Turkey Red Oil, (Quaker 2800), Quaker Chemical

DETAILS OF THE LABORATORY SOILAGE TEST——
1) *Preparation of Soil.* Vacuum cleaner dirt was collected from about a dozen residences in the Summit, NJ area. After "sterilization" in the oven overnight at 110°C, the soil was sifted through a 15-mesh screen. Several pounds of this material were then mixed thoroughly and stored in the conditioning room at 65% RH. A rough analysis of the first batch of dirt was as follows:

	%
Ether extractables	6.4
Alcohol extractables	6.0
Water extractables	5.1
Ash content	50.1
Lint, moisture, & other	32.4

2) *Soiling Procedure.* A 2½-gram sample of 2/54's carpet yarn which had also been conditioned at 65% RH, was cut into one-inch lengths. The yarn, together with 10 grams of soil and forty ¾-inch pebbles, was placed in a one-quart porcelain ball-mill jar and run in the ball-mill at 75 rpm for one hour. After removal from the jar, the soiled yarn was transferred to the sifter for removal of excess soil. This was accomplished by placing a 48-mesh screen on top of the sifter and alternately blowing a stream of air into top and bottom. The air was always kept at 30 cms of mercury pressure and emerged through a 5 mm opening for three minutes. The sample was then stored in a 2-ounce bottle.

3) *Soilage Evaluation Technique.* The relative degree of soilage of the various yarn samples was established by comparing the reflectance values as determined by the Hazemeter. The Hazemeter is similar to the Hunter Hazemeter made by Henry P Gardner Laboratories. The essential features of the instrument's performance are as follows:

a) A small beam of tungsten light passes through the white interior of a sphere and through a hole on the opposite side.

b) A 1½-gram yarn sample is packed into a one-inch bottle screw cap and held by a spring against a glass disk, which covers the opening in the sphere.

c) Light reflected by the sample is collected inside the white sphere and the intensity measured by a photoelectric cell and galvanometer. In running a test, a blank white reading was first established by noting the reflectance value of a magnesia block behind the glass disk. This figure, which was usually about 250 mm of length on the galvanometer scale, was considered to be 100% white. The reflectance figures for the sample were computed as percent white relative to this blank reading. When a sample was run on the Hazemeter, five readings were taken. Between readings, the surface of the samples was rearranged to minimize the effect of surface irregularity on the average value. The validity of the method can be seen in the following table where reflectance values are compared with visual impressions.

acetate yarn	*unsoiled* %	*soiled* %	*visual impression*
original	70	27	original
1.1% silicone resin	72	30	lighter
1.3% nonionic softener #1	70	26	same
1.4% paraffinic wax	70	21	darker

Fourth in a Series——

PRELIMINARY STEPS IN THE DEVELOPMENT OF AN ACCELERATED LABORATORY TEST FOR CHLORINE-RETENTION PROPERTIES IN RESIN-TREATED FABRICS

GEORGE SIMS WHAM, JR and PAULINE BEERY MACK*

College of Household Arts and Sciences
Texas State College for Women

INTRODUCTION

THE experimental fabrics used by Wham and Mack (*1*) in studies on strength changes in melamine-formaldehyde resin-finished fabrics were made with alternate colored and white areas, and the same dyes were used on the resin-finished and on comparable control fabrics, which were finished without a resin aftertreatment.

Although, in good laundry practice the use of chlorine in home or commercial washing is not recommended for any colored fabrics except the fastest of dyed cottons used for such purposes as uniform material, observations were made as a matter of interest on the color changes appearing in the aforementioned studies devoted primarily to strength changes.

The laundering, laundering and pressing, laundering and exposure to light in the Fade-Ometer, and laundering and exposure to daylight through window glass treatments were the same in the study covered by this report as those described previously by these same authors (*1*).

The laundry procedure consisted of four suds baths and five rinses, with 160°F the highest temperature in any step in the operation, and with a low concentration of sodium hypochlorite (yielding 0.01 per cent of available chlorine) applied in the fourth suds.

The color changes appearing in the fabrics were evaluated visually in a dark box equipped with a light source having a color temperature of 2780°K. The samples were graded on a light gray background which was placed on a black surface held at an angle of 45°, the light

This is the fourth in a series of reports on chlorine retention by textile finishes, sponsored by the American Viscose Corporation through a fellowship conducted at the Ellen H Richards Institute, School of Chemistry and Physics, The Pennsylvania State College, and currently at the Texas State College for Women.

* The investigation upon which this report is based was conducted in major part while Dr Mack was director and Dr Wham a research faculty member of the Ellen H Richards Institute, School of Chemistry and Physics, The Pennsylvania State College, and concluded after both joined the faculty of the Texas State College for Women.

TABLE I

VISUAL JUDGMENT OF COLOR CHANGES IN EXPERIMENTAL FABRICS WHEN LAUNDERED BY A PROCEDURE INVOLVING CHLORINE, AND WHEN PRESSED AND LIGHT EXPOSED IN ADDITION TO LAUNDERING

Number of Launderings		*(1)*		*(5)*		*(10)*		*(15)*		*(20)*	
Treatment		*Melamine-formaldehyde resin-finished (Class)*	*Control (Class)*	*Melamine-formaldehyde resin-finished (Class)*	*Control (Class)*	*Melamine-formaldehyde resin-finished (Class)*	*Control (Class)*	*Melamine-formaldehyde resin-finished (Class)*	*Control (Class)*	*Melamine-formaldehyde resin-finished (Class)*	*Control (Class)*
FABRIC I, STRIPED											
Laundered	Blue	1.0	1.0	1.0	1.0	2.0	1.0	4.0*	2.0	4.0*	3.0
	Grey	1.0	1.0	2.0	1.0	4.0	2.0	4.0*	3.0	4.0*	4.0
Laundered, Pressed	Blue	1.0	1.0	1.0	1.0	2.0	1.0	4.0*	2.0	4.0*	3.0
	Grey	1.0	1.0	2.0	1.0	4.0	2.0	4.0*	3.0	4.0*	4.0
Laundered, Fade-Ometer Exposed	Blue	1.0	1.0	1.0	1.0	2.0	2.0	4.0*	3.0	4.0*	4.0
	Grey	2.0	2.0	2.0	2.0	4.0	3.0	4.0*	3.0	4.0*	4.0
Laundered, Pressed, Fade-Ometer Exposed	Blue	1.0	1.0	1.0	1.0	3.0	2.0	4.0*	3.0	4.0*	4.0
	Grey	3.0	2.0	4.0	2.0	4.0	3.0	4.0*	3.0	4.0*	4.0
FABRIC II, CHECKED											
Laundered	Black	1.0	1.0	1.0	1.0	4.0*	4.0	4.0*	4.0	4.0*	4.0
	Red	1.0	1.0	1.0	1.0	2.0*	2.0	3.0*	3.0	3.0*	3.0
Laundered, Pressed	Black	1.0	1.0	1.0	1.0	4.0	4.0	4.0*	4.0	4.0*	4.0
	Red	1.0	1.0	1.0	1.0	2.0	2.0	3.0*	3.0	3.0*	3.0
Laundered, Fade-Ometer Exposed	Black	1.0	1.0	3.0	2.0	4.0*	4.0	4.0*	4.0	4.0*	4.0
	Red	1.0	1.0	2.0	2.0	3.0*	2.0	3.0*	3.0	4.0*	4.0
Laundered, Pressed, Fade-Ometer Exposed	Black	1.0	1.0	3.0	3.0	4.0*	4.0	4.0*	4.0	4.0*	4.0
	Red	1.0	1.0	2.0	2.0	3.0*	3.0	3.0*	3.0	3.0*	4.0

* White areas yellowed in addition to the designated degree of fading of colored areas.

TABLE II

VISUAL JUDGMENT OF COLOR CHANGES IN EXPERIMENTAL FABRICS WHEN EXPOSED TO DAYLIGHT THROUGH WINDOW GLASS FOR VARIOUS PERIODS OF TIME, WITH AND WITHOUT 10 PRELIMINARY LAUNDERINGS BY A PROCEDURE INVOLVING CHLORINE

		Not Exposed to Light		*Exposed for Designated Period of Time*									
				1 week		*1 month*		*2 months*		*3 months*		*4 months*	
Treatment		*Melamine-formaldehyde resin-finished (Class)*	*Control (Class)*	*Melamine-formaldehyde resin-finished (Class)*	*Control (Class)*	*Melamine-formaldehyde resin-finished (Class)*	*Control (Class)*	*Melamine-formaldehyde resin-finished (Class)*	*Control (Class)*	*Melamine-formaldehyde resin-finished (Class)*	*Control (Class)*	*Melamine-formaldehyde resin-finished (Class)*	*Control (Class)*
FABRIC I, STRIPED													
Not Laundered	Blue	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	2.0	2.0	2.0	2.0
	Grey	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	3.0	3.0	4.0	4.0
Laundered 10 times before exposure	Blue	2.0	2.0	2.0	2.0	3.0	2.0	3.0	2.0	4.0*	2.0	4.0*	3.0
	Grey	1.0	1.0	4.0	3.0	4.0	3.0	4.0	3.0	4.0*	4.0	4.0*	4.0
FABRIC II, CHECKED													
Not Laundered	Black	1.0	1.0	1.0	1.0	1.0	1.0	1.0	2.0	2.0	2.0	2.0	2.0
	Red	1.0	1.0	1.0	1.0	1.0	1.0	1.0	2.0	2.0	2.0	2.0	2.0
Laundered 10 times before exposure	Black	3.0	3.0	4.0	4.0	4.0*+	4.0	4.0*+	4.0	4.0*+	4.0	4.0*+	4.0
	Red	1.0	1.0	2.0	2.0	2.0*	2.0	2.0*	2.0	2.0*	3.0	2.0*	3.0

* White areas yellowed in addition to the designated degree of fading of colored areas.

illuminating the surface from above. The following classifications were followed in assigning the ratings to the treated fabrics:

Class 1, no observable fading;

Class 2, only slight fading;

Class 3, some fading, but not sufficient to render a fabric unfit for further service;

Class 4, severe fading, sufficient to render a fabric unfit for further service.

Class 4,* extraordinarily severe fading.

Standard for each of these classes for each major color and shade have been prepared by the senior author of the study for comparative purposes, in order to effectuate standardization of this grading.

FINDINGS AND DISCUSSION

Table I shows the classifications given by visual inspection to the resin-finished fabrics and their corresponding control fabrics without resin during the series of high-temperature, low-chlorine-concentration commercial launderings, and the series which included also combinations of pressing and light exposure in the Fade-Ometer, as designated.

Table II shows the color classification data for the window exposure series of fabrics, some of which received and some of which did not receive 10 commercial laundry treatments (involving chlorine) before the window exposure.

The two ratings for each observation of Fabric I and its control refer to two colors, dark blue and light blue, in this striped rayon. The two ratings for Fabric II apply to two colors (black and red) in this checked fabric. Both fabrics had alternating white areas, as noted.

The dyes on these fabrics were the following types:

Fabric I (striped)
Dark blue and light blue—direct colors
Fabric II (checked)
Red—vat color
Black—analine

Table I shows that, in the laundering series, the first of the melamine-formaldehyde resin-finished fabrics (Fabric I) retained its original color, as nearly as could be judged visually, through the first washing for both colors, and through the fifth washing for one color. After the first washing the control fabric ranked higher than the resin-finished fabric throughout.

In the second of the resin-finished rayons of the melamine type (Fabric II), no fading was observed through five washings. By the tenth washing, when the next series of observations was made, however, both the resin-finished and the control had faded to Class 4 in one color. In the other color, both pairs showed the same degree of progressive fading from the tenth washing.

The laundered and pressed series for both resin-treated fabrics and their comparable controls were rated identically with the series of laundered fabrics which were not pressed.

The laundering-light treatments exhibited fading on one color of Fabric I beginning with the first washing, with the resin treated showing more fading than its control except after the twentieth washing, when both were rated as Class 4. No visible fading appeared on the other color of this fabric until the tenth washing, with the control somewhat better than the resin-treated until both had reached Class 4 after the twentieth washing. Fabric II showed fading earlier in the laundering-light series than in the series which had been laundered only, with some tendency for the resin-treated fabric to have a lower rating than its control until fading became severe in both.

The laundering-light pressing series in some cases showed a somewhat greater degree of fading than did the series which was laundered and light-exposed without the pressing, in both fabrics.

Yellowing or darkening of the white areas in both fabrics appeared at the close of the fifteenth washing, regardless of the treatment or combination of treatments. The darkening tended to be somewhat more severe in the treatments involving pressing. No yellowing or darkening appeared on the control fabrics which were not resin-treated.

Qualitative tests on the fabrics showed the presence of chlorine in the resin-treated fabrics which had been laundered by the procedure involving chlorine, but not in the nonresin-treated controls.

In 80 paired observations on the two resin-treated fabrics and their comparable controls during the several laundering, pressing, and Fade-Ometer exposure series, 70 per cent of the classifications were the same for the resin-finished fabric and its comparable control, 28.75 per cent were lower for the melamine-finished fabrics than for the control; and 1.25 per cent (one case) was higher for the resin-treated than for the control fabric.

Table II shows that, when Fabric I was exposed to light through window glass without preliminary launderings, no observable fading had occurred in the resin-treated fabric or the control at the close of the two-month period. Thereafter through the close of the final period of

exposure (four months), the melamine-formaldehyde resin-finished fabric and the paired control showed comparable fading in both colors in the fabric.

When this same fabric was laundered 10 times by a process which included a low concentration of chlorine, but was not exposed to daylight through window glass, one color (blue) faded slightly (Class 2), both in the resin-treated and the control fabric. The other color (grey) showed no observable fading. After one week of window exposure, however, fading began to be noted, with the resin-treated fabrics higher than their paired controls in all cases except those in which both fabrics of the pair had reached a Class 4 rating.

In Fabric II, light exposure inside of window glass without preliminary laundering produced no fading in the resin-treated fabric through two months, whereas the control had faded to Class 2 in both colors at this time. The melamine resin-finished fabric had faded to Class 2 in both colors by the end of three months; and neither the resin-finished fabric nor the control faded beyond this classification in either color by the end of the four-month test.

After 10 launderings without subsequent window exposure, the black areas in Fabric II had faded to Class 3, both in the resin-finished and the control specimens, but the red areas remained in Class 1. After one week of window exposure, the black areas both in the melamine-formaldehyde resin-finished and the control had faded to Class 4, and the red to Class 2. The black areas of the resin-treated specimens were rated as more severely faded within the Class 4 category than the control at every subsequent examination period. In the more colorfast red areas, the resin-treated specimens never fell below Class 2 throughout the four-month exposure, whereas the control was rated as Class 3 at the three- and four-month periods.

Yellowing or darkening of white areas appeared in Fabric I at three months and in Fabric II at one month of light exposure following the preliminary launderings (with chlorine used in small concentrations in the the procedure) in the resin-treated but not in the comparable control specimens. No such yellowing or darkening appeared in the fabrics which had not been laundered before the window exposure.

To summarize, the four color areas in the two resin-finished fabrics and their paired controls during window exposure, and during window exposure preceded by 10 launderings involving chlorine:

In the window exposure series without preliminary laundering, 91.7 per cent of the pairs had the same color rating, whereas, in 8.3 per cent the resin-treated fabrics showed less fading than their controls.

In the window exposure with 10 preliminary chlorine-involving launderings, 41.7 per cent of the paired specimens were classified the same in color retention, with 50.0 per cent of the controls given higher colorfastness ratings than the comparable resin-treated specimens, and 8.3 per cent of the resin-finished fabrics higher than their controls.

SUMMARY

In studies on chlorine retention properties of resin-treated rayon fabrics, two fabrics of two colors each together with alternate white areas had been treated with a melamine-formaldehyde resin finish, and the controls of the same fabrics were finished without a resin aftertreatment.

When the paired fabrics were given a series of commercial launderings according to a nine-step formula which had 160°F as the maximum temperature and which included a low concentration (0.01 per cent) of chlorine in the fourth suds, with and without pressing and light exposure in a Fade-Ometer, there was a somewhat greater tendency for the resin-finished than for the comparable control color areas to fade.

When the paired specimens of the fabrics were exposed through window glass without preliminary launderings, and were examined periodically throughout a four-month period, the comparable color areas were rated the same except in two of twenty-four paired observations, in which the resin-treated fabrics ranked higher than the controls.

When the fabrics were given 10 preliminary launderings according to the commercial process which included a low concentration of chlorine in the fourth step, one-half of the pairs graded poorer for the resin-finished than for the comparable controls, and all of the remainder except two of the 24 pairs received the same classifications.

Yellowing or darkening of white areas in the fabrics appeared only in the resin-treated fabrics and only after the laundry treatment involving chlorine.

The differences in colorfastness between the resin-finished and the control fabrics in colorfastness were not so great as the strength differences shown in chlorine-retentive tests reported previously on the same fabrics (*1*). Where color loss differences apparently resulting from chlorine retention appeared, however, they tended to be greater for the fabrics with the melamine-formaldehyde resin-finished specimens.

ACKNOWLEDGMENTS

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Book Review

Medicinal Chemistry — Volume II

Alfred Burger
Interscience Publishers (1951)

THIS advanced treatise of the chemistry, biochemistry, and therapeutic and pharmacological action of natural and synthetic drugs will serve a useful purpose as a reference for chemists, biochemists, and microbiologists. There is sufficient information on the different phases of drugs to warrant the book's use in any of the above mentioned fields. The syntheses of many of the common drugs are given along with some of the chemical reactions. There are sections on chemotherapy, antibiotics, dyestuffs, and antiseptics, especially useful to the microbiologist. These sections in particular are written in a manner which subject matter can be readily followed by the novice. The author has kept up to date with many of the advances in the fast moving field of drugs. He has utilized a bibliography of over six hundred and fifty references.—HB

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American Association of Textile Chemists and Colorists

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Secretary.....AZEL W MACK, Dexter Chemical Corp, 581 Boylston St, Boston 16, Mass
Vice-Chairman—JOHN M GOULD *Treasurer*—WILLIAM W PENNOCK

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Chairman.....ERNEST J CHORNYEI, Bradford Dyeing Association, Westerly, R I
Secretary.....ROBERT G THOMAS, Rohm & Haas Co, Inc, 2001 Industrial Trust Bldg, Providence 3, R I
Vice-Chairman—ARTHUR F McLEAN *Treasurer*—J WILLIAM TIMPERLEY

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Secretary.....NATHANIEL J GLADE, American Cyanamid Co, Stamford, Conn
Vice-Chairman—ARTHUR S NYQUIST
Treasurer—SOCRATES V VANIOTIS

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HUDSON-MOHAWK

Chairman.....HAROLD S DAHLBERG, Kenwood Mills, Rensselaer, N Y
Secretary.....WILLIAM A NELSON, Ritter Chemical Company, Inc, 403 W Main St, Amsterdam, N Y
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Chairman.....HARRY L MORGAN, James Lees & Sons Co, Bridgeport, Pa
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Secretary...CLARENCE HOOPER, Burlington Mills Corp, Burlington, N C
Vice-Chairman.....HENRY A RUTHERFORD
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Secretary...JOSEPH T BOHANNON, JR, American Aniline Products, Inc, 4001 Rossville Blvd, Chattanooga 7, Tenn
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Chairman.....S JACK DAVIS, The Chemstrand Corp, Decatur, Ala
Secretary....JAMES W SWINEY, Fulton Bag & Cotton Mills, Atlanta, Ga
Vice-Chairman—T HOWARD McCAMY *Treasurer*—WILLIAM B AMOS

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Vice-Chairman—HENRY D BARKER *Treasurer*—HERBERT A EHRMAN

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Secretary.....VICTOR H LAWRENCE, Geigy Co, Inc 629 W Washington Blvd, Chicago, Ill
Vice-Chairman—J GORDON STOTT *Treasurer*—KIRK P FERGUSON

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Chairman....EDWARD J STEPHEN, Paris Woolen Mills, Stayton, Ore
Secretary....THEODORE M MARSHALL, Nyanza Color and Chemical Co, Inc, 115 SW Fourth Ave, Portland 4, Ore
Vice-Chairman—DON ADAMS *Treasurer*—JOHN L AYRES

PACIFIC SOUTHWEST

Chairman.....SIDNEY SPRINGER, Textile Chemicals and Equipment, 2300 S Vermont Ave, Los Angeles 7, Calif
Secretary....CLARICE H LINDSEY, Univ of California, 405 Hilgard Ave, Los Angeles 24, Calif
Vice-Chairman—ROBERT ROTH *Treasurer*—SERGIO DADONE

Student Chapters

BRADFORD DURFEE TECHNICAL INSTITUTE, CLEMSON COLLEGE, FAIRLEIGH DICKINSON COLLEGE, GEORGIA INSTITUTE OF TECHNOLOGY, LOWELL TEXTILE INSTITUTE, NEW BEDFORD TEXTILE INSTITUTE, NORTH CAROLINA STATE COLLEGE, PHILADELPHIA TEXTILE INSTITUTE, RHODE ISLAND SCHOOL OF DESIGN, UTICA TECHNICAL INSTITUTE.

EMPLOYMENT REGISTER

This column is open for two insertions per year, per member, without charge. Blanks can be obtained from and filed with, the Secretary of the Association, Lowell Textile Institute, Lowell, Mass. It is understood that these will be open to inspection by prospective employers who can obtain further information from the Secretary.

53-9

Education: B S in chemistry and dyeing,
Experience: laboratory and assistant foreman, cotton dyeing.
Age: 34; married; veteran; references; executive position in dyeing or finishing. South or Southeast desired. 5-25, 6-8

53-10

Education: Chemistry, college and graduate school, Denmark, five months study in U S.
Experience: Manager of large dyehouse specializing in wool.
Age: 36; married; now resident in western U S and seeking position there. 5-25, 6-8

53-11

Education: B S in chemistry and dyeing, Philadelphia Textile Institute.
Experience: Textile chemist and dyer of woolen and worsted pieces, yarn & top.
Age: 30; married; technical sales or production position preferred. 6-8, 6-22

53-13

Education: B A, Chemistry, with two years graduate work in chemical engineering, plastics and business administration.
Experience: Salesman and engineer.
Age: 33; unmarried; references; position in sales management desired. 6-8, 6-22

CALENDAR

AATCC

NATIONAL CONVENTIONS
September 17-19, 1953 (Hotel Conrad Hilton, Chicago); Sept 15-18, 1954 (Atlanta Biltmore, Atlanta, Ga); Sept 21-23, 1955 (Chalfonte-Haddon Hall, Atlantic City, N J).

HUDSON-MOHAWK SECTION
June 19 (Outing).

MID-WEST SECTION
June 13 (Outing, Lake Lawn Lodge, Delavan, Wis); November 7, February 13 (Hotel Bismarck, Chicago, Ill).

NEW YORK SECTION
June 19 (Outing, North Jersey CC, Wayne, N J); Sept 25, Oct 3, Nov 20 (Swiss Chalet); Jan 29, Feb 26 (Hotel Statler, N Y); April 23, 1954, May 21, 1954 (Swiss Chalet).

NORTHERN NEW ENGLAND SECTION
June 19 (Annual Outing, Merrimack Valley CC, Methuen, Mass.); Nov 6 (LTI); Dec 4 (MIT Faculty House).

PHILADELPHIA SECTION
Sept 11, Oct 23 (Penn-Sheraton Hotel, Philadelphia, Pa); Dec 4; Jan 15, 1954.

PIEDMONT SECTION
June 12-13 (Mayview Manor, Blowing Rock, N C); Sept 12 (Hotel Charlotte, Charlotte, N C).

RHODE ISLAND SECTION
June 12 (Outing, Wannamoisett C C); Oct 23 (Prov Eng Soc); Dec 4 (Annual Meeting, Sheraton-Biltmore, Providence).

SOUTHEASTERN SECTION
June 19-20 (Outing, Radium Springs).

SOUTH CENTRAL SECTION
Aug 21-22 (Outing, Chattanooga Golf & Country Club, Chattanooga, Tenn); Dec 5 (Patten Hotel).

WESTERN NEW ENGLAND SECTION
June 19 (Outing, Wallingford Country Club); Oct 2, Nov 6 and Dec 11 (Rapp's).

OTHER EVENTS

AMERICAN OIL CHEMISTS' SOCIETY
27th Fall Meeting, November 2-4, Sherman Hotel, Chicago, Ill.

AMERICAN SOCIETY FOR TESTING MATERIALS
1953 Annual Meeting, June 29-July 3, Chalfonte-Haddon Hall, Atlantic City, N J; 1953 Fall Meeting, Oct 14-16, New York, N Y.

AMERICAN TEXTILE MACHINERY ASSOCIATION
Exhibit of American Textile Machinery, April 26-May 1, 1954, Atlantic City Exhibition Hall, Atlantic City, N J.

ASSOCIATION OF CONSULTING CHEMISTS AND CHEMICAL ENGINEERS, INC
Annual Meeting—25th Anniversary-October 27 (Hotel Belmont Plaza, New York).

CANADIAN ASSOCIATION OF TEXTILE COLOURISTS AND CHEMISTS (Quebec Section)
June 20 (Annual Golf Tournament).

GARMENT DYERS GUILD OF AMERICA
1953 Technical Clinic, June 12-13 (Seneca Dye Works & Hotel Powers, Rochester, N Y)

GORDON RESEARCH CONFERENCES
June 16-Sept 4 (Colby Jr College, New London, N H).

INTERNATIONAL FEDERATION OF TEXTILE CHEMISTS AND COLORISTS ASSOCIATIONS
1953 Congress: September 17-19, Luzern, Switzerland (under the auspices of the Swiss Association of Chemists-Colorists).

NEW YORK BOARD OF TRADE (DCAT)
Drug, Chemical and Allied Trades Section; 63rd Annual Meeting, Sept 24-27, Pocono Manor Inn, Pocono Manor, Pa.

SOUTHERN TEXTILE EXPOSITION
October 4-9 (Textile Hall, Greenville, S C)

SYNTHETIC ORGANIC CHEMICAL MANUFACTURERS ASSOCIATION OF THE UNITED STATES
June 11-13 (Joint Outing with Manufacturing Chemists' Association at The Greenbrier, White Sulfur Springs, W Va.

TEXTILE RESEARCH INSTITUTE
1953 Annual Meeting, Nov 12-13.

TEXTILE WORKSHOP
3rd Annual Meeting: June 10-July 1, Lowell, Mass.

MEMBERSHIP

AS OF

MAY 1, 1953

SECTION	Sr	Jr	Assoc	Stu	Total 1953	1952	1951	1950	1949	1948	1947	1946	1945	1944	1943
Northern New England	461	29	81	4	575	576	571	567	545	550	556	528	469	402	407
Western New England	137	11	22		170	158	154	144	142	97					
Rhode Island	530	50	85	2	667	680	674	589	556	511	501	471	405	348	352
New York	1167	102	197	2	1468	1468	1361	1335	1282	1285	1262	1167	1008	817	707
Hudson Mohawk	145	12	27		184	190	181	163	117						
Philadelphia	818	52	116	2	988	1042	1009	971	930	871	833	740	644	550	513
Washington	101	8	6	3	118										
Piedmont	634	90	83	2	809	778	728	669	587	511	492	434	366	326	286
South Central	125	6	17		148	156	144	140	128	111	102	100	87	83	72
Southeastern	220	15	37	1	273	243	229	237	224	209	198	166	141	141	146
Mid-West	337	17	60	3	417	385	353	341	336	337	326	287	261	209	198
Pacific Northwest	36	2	4		42	30	32	35							
Pacific Southwest	86	2	8		96	106	92	83	115	81					
Student Chapters				238	238	273	339	421	312	240	142	50	14	20	56
Unclassified	356	34	121	9	520	488	412	369	340	286	286	237	199	151	122
	5153	430	864	266	6713	6573	6279	6064	5614	5089	4698	4180	3594	3047	2859
Corporate					310	269	282	295	300	300	299	302	299	184	82
TOTALS					7023	6842	6561	6359	5914	5389	4997	4482	3893	3231	2941

THE AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS
LOWELL, MASSACHUSETTS

The Second Edition of the
COLOUR INDEX

Since the Second Edition of the Colour Index will be much more costly than the First Edition, owing to the great increase in size (from one to five volumes) and to the general rise in prices since the latter was first published (1924), the Association has prepared the following scheme of payments. The three annual payments (b) may prove convenient especially to individual purchasers; while the single payment (a) represents a considerable reduction on the final purchase price, and will help the Association both in financing the project and by giving an indication of the immediate demand for the work.

(a) Single payment before September 1, 1953	$85.00
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1) First payment before September 1, 1953	31.00
2) Second payment before June 30, 1954	31.00
3) Third payment on publication (1955)	31.00
	$93.00
(c) Single payment on publication (1955) not less than	$99.00

Prices as quoted above include packing and postage to destination.

NOTES

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A 2½% discount will be allowed book dealers on fully paid Plan (a) Orders placed with The American Association of Textile Chemists and Colorists, Lowell, Massachusetts, before September 1, 1953.

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Please make checks payable to the American Association of Textile Chemists and Colorists.

EXECUTIVE COMMITTEE
1953 CONVENTION

Seated (l to r): L B MacFarland, American Aniline Products, Inc—TRANSPORTATION; Joseph H Jones, Phoenix Dye Works—ASSISTANT CHAIRMAN and HOTEL; Eric W Camp, National Aniline Division—GENERAL CHAIRMAN; Jack G Kelley, Du Pont—PUBLICITY; Frank F Myers, Geigy Co, Inc—DINING

Standing (l to r): Elliott Morrill, The Best Foods, Inc—TECHNICAL; J Gordon Stott, Ciba Co, Inc—PRINTING; C M Clevenger, Rohm & Haas Co—RECEPTION; William Boyd, Jr, Ciba Co, Inc—LADIES; Samuel Klein, Calco Chemical Division—EXHIBITS; George B Chabot, Jr, Calco Chemical Division—ENTERTAINMENT

Missing from the picture: K P Ferguson, Du Pont—FINANCE, and Erwin J Sindt, National Aniline Division—REGISTRATION

LADIES' ACTIVITIES AT 1953 CONVENTION
(Tentative)

Thursday Afternoon, Sept 17th—Tea, Conrad-Hilton Hotel—Ladies Room Number 4.

Friday Morning, Sept. 18th—Breakfast Club—Morrison Hotel, 7:30 AM; Program from 8:00-9:00 AM; Merchandise Mart Tour—10:30 AM.

Friday Noon—Carson Pirie Scott & Co—12:00 Noon; Luncheon and style show—About 1 hour.

Friday Afternoon—Tribune Tower Tour—2:00 PM.

Saturday Morning, Sept 19th—Planetarium—11:00 AM.

Saturday Afternoon—Free time—Suggested trips—Museum of Science & Industry—Field Museum—Aquarium.

Neal Truslow (left), Chairman of the Piedmont Section's Intersectional Contest Committee, is shown presenting the completed copy of the 1953 Intersectional Contest Paper for the Piedmont Section to Frank J O'Neil, National Chairman of the Intersectional Contest. The paper was completed in April.

EXHIBIT SPACE AT 1953 CONVENTION

Although a few exhibit spaces are still available at the Convention, July 1st has been set as a deadline for applications. Those still desiring space should address applications to the Exhibit Chairman:

Samuel Klein
Calco Chemical Division
American Cyanamid Company
3505 N Kimball Avenue
Chicago 18, Illinois

WNE Outing at Wallingford

CARL F Schilkowsky, Outing Chairman of the Western New England Section, has announced the following Program committee for the Section's 6th Annual Outing at the Wallingford (Conn) Country Club on June 19:

Donations—L O'Connell, Sidney Blumenthal

Games—A Rant, Laurel Soap Company

Awards—A H De Marco, Shelton Hosiery Mills

Golfing will begin at 10:30 a m, with horseshoes, chess, etc slated throughout the day.

Dinner will be served at 7:30 p m.

—♦ ♦—

Pacific Northwest Section Meeting Report

April 24, 1953
Portland, Oregon

A REGULAR meeting of the Pacific Northweest Section was held in Portland, Oregon, April 24, 1953.

In the afternoon, the group assembled at the Jantzen Knitting Mills for a trip through the plant, under the auspices of Carl Jantzen.

The evening dinner meeting in the Marine Room of the Multnomah Hotel attracted forty-two members and guests. Plans were discussed for the annual summer outing, to be held at the Mt Hood Country Club, Welches, Oregon. An Outing Committee was appointed, consisting of John L Ayres, Hugh C Osborn, and William H Kibbel, Jr. The preparation of a Sectional paper was discussed by our past Chairman, Otto E Schmidt. Following the regular business, Ralph O Wescott, Production Manager of Jantzen Knitting Mills, discussed the development of the swim suit.

Respectfully submitted,
T M MARSHALL, *Secretary*

Membership Applications

May 20, 1953

SENIOR

William H Angevine, Jr—Chemist, Research & Development Dept, Cranston Print Works Company, Cranston, R I. Sponsors: R H Phillips, W J Crawford

Ernest Blakely, Jr—Sales rep of textile finishes, C S Tanner Co, Providence R I. Sponsors: E A Murray, C S Tanner

Robert G Bolander—Chemist & supt of Dyeing & Finishing, Rocky Mountain Textile Mills, Inc, Denver, Colo. Sponsors: A A Barker, E L Lueck

Allen L Brassell—President, United States Testing Co, Inc, Hoboken, N J. Sponsors: C A Baker, A J Kellner

Paul U Bretschger—Sales rep, Becco Sales Corp, Buffalo, N Y. Sponsors: J F Shea, B K Easton

Richard J Brusco—Chemical engineer, Bigelow Sanford Carpet Co, Thompsonville, Conn. Sponsors: J M Roddy, C R Johnson

Charles E Buck—Group leader, Research & Development Dept, Colgate-Palmolive-Peet Co, Jersey City, N J. Sponsors: J A Woodhead, E A Leonard

Fernand Collette—Salesman & serviceman, The Ault & Wiborg Co of Canada, Ltd, Montreal, Canada. Sponsors: A H Siepert, O J Agricola

Mark H Costello—Supt of Package & Cake Dyeing, Malina Co, New York, N Y. Sponsors: J G Falcon, R T Mullin

Robert H Cudderback—Colorist, Consolidated Textile Corp, Windsor Print Works Div, No Adams, Mass. Sponsors: W A Green, R G Perriello

Rowena P Dowlen—Home economist, research, U S Dept of Agriculture, Bureau of Human Nutrition & Home Economics, Washington, D C. Sponsors: A R Macormac, M S Furry

James R Ellis—Asst dyer, Central Franklin Process Co, Chattanooga, Tenn. Sponsors: A R Williams, Jr, H Whelchel

Harold W Ellsworth—West Coast Carpet Dyers, Burbank, Calif. Sponsors: F L Wilhelm, M Kramer

Lewis Ewan—Div supt of dyeing, James Lees & Sons Co, Bridgeport, Pa. Sponsors: H L Morgan, M A Noonan

Roland O Gagnon—Textile technologist, charge of lab, Amoskeag-Lawrence Mills, Inc, Manchester, N H. Sponsors: E E Fickett, H C Chapin

Gordon A Geselbracht—Plant mgr, Cincinnati Chemical Wks, Norwood, O. Sponsors: T Heginbotham, O Hagist

Edgar H Gordon—Head Piece Dyer, Marshall Field & Co, Fieldale, Va. Sponsors: J N Fletcher, F H Dudley

John H Greer—Vice-pres, production, Monroe Chemical Co, Quincy, Ill. Sponsors: E J Sindt, E W Camp

Selby B Groff—Pres & Treas, Wamesit Processing Co, Wamesit, Mass. Sponsors: K H Schmatzler, M E Keane

Earl W Hazekamp—Lab mgr, General Dyestuff Corp, Chicago Ill. Sponsors: H E Hager, J L Eich

Edward Kamphausen — Production mgr and production coordinator, La Garantia A Dishington S A, Colombia. Sponsor: H P Hoffmann

Howard L Leventhal—Div technical dir, The Visking Corp, North Little Rock, Ark. Sponsors: J A Verhage, W W Bussey

Frank W Long—Project mgr, text dyeing & finishing, Philadelphia Quartermaster Depot, Philadelphia, Pa. Sponsors: D Leshin, F J Rizzo

George S McCarty, Jr—Sales, textile chemical specialties, E S Browning Co, Los Angeles, Calif. Sponsors: L P Brick, A R Jenny

Howard S McCullough—Tech rep, George E Missbach & Co, Atlanta, Ga. Sponsors: L Shapiro, S J Baum

Francis C Mudge—Mgr, technical service, Wheat Industries, Pty Ltd, Sydney, Australia. Sponsors: A R Robbins, L Gussman

Alex Murray—Asst colorist, Consolidated Textile Corp, Windsor Print Wks Div, No Adams Mass. Sponsors: W A Green, R G Perriello

Frank Nistico—Instrumentation engr, Celanese Corp of America, Summit, N J. Sponsors: F Fortess, V S Salvin

Edward C Pfeffer—Vice-pres in charge of research, Cluett, Peabody & Co, Troy, N Y. Sponsors: J M Merrill, L S Lang

James H Purnell, Jr—Supervisor, Pilot Plant, The Chemstrand Corp, Decatur, Ala. Sponsors: S J Davis, J A Swiney

Dominick Scrima — Dyer, Rock River Woolen Mills, Janesville, Wis. Sponsors: C B Mascroft, J G Kelley

John P Seguin—N E sales rep, Alco Oil & Chemical Corp, Providence, R I. Sponsors: F McCawley Tolin, O B Hager

Ralph L Shull—Dyer, Pendleton Woolen Mills, Pendleton, Ore. Sponsors: T M Marshall, D W Kimsey

John F Synan—Mgr, Market Development Dept, Mathieson Chem Corp, Baltimore, Md, Sponsors: R L Carr, W P terHorst

Donald J Tobin—Quality control supt, Champlain Spinners, Inc, Whitehall, N Y. Sponsors: H Gendreau, N Webber

Robert E Watson—Dyer, Ace Dyeing & Finishing Co, Inc, West Warwick, R I. Sponsors: S W Freeman, V Snowden

Jan L Weissink—Textile chemist, N V Textielfabriek, Enschede, Netherlands. Sponsors: W B Wilson, W E P van Oordt

Hugh E Zona—Lab tech, Colgate Piece Dye Works, Hawthorne, N J. Sponsors: C R Trommer, M Crown

JUNIOR

William S Connery—Shift overseer of dyeing, Hampton Mills, Inc, Easthampton, Mass. Sponsors: C R Cayen, F H Dickinson

Robert W Deobler—Junior chemist, General Dyestuff Corp, New York, N Y. Sponsors: C Z Draves, L S Thompson

Stanley W Fink—Textile technologist, Triangle Finishing Corp, Johnstown, N Y. Sponsors: F Kennedy, A D Truman

Barton MacDonald—Salesman, Monsanto Chemical Co, New York, N Y. Sponsors: A H Rant, W E Breagy

Jean C Pomeon—Technical Dept, G Balay & Co, St Etienne, France. Sponsors: C A Heydon, R J DeWitte

Franklin P Swain, Jr—Asst to pres, Sec of Corp, Wamesit Processing Co, Wamesit, Mass. Sponsors: K H Schmatzler, M E Keane

Ursula Vosburgh — Textile technologist, Cluett, Peabody & Co, Inc, Troy, N Y. Sponsors: J N Merrill, L S Lang

ASSOCIATE

Carl J Bartholmew—Owner, Valor Rug & Upholstery Cleaners & Dyers, Bremerton, Wash.

George D Bennett—Salesman, Merchants Chemical Co, Inc, Cincinnati, O.

Dean Foster—Director of Laboratories, U S Testing Company, Hoboken, N J.

Morris M Greenwald—General manager, Roary Chemical Corp, Brooklyn, N Y.

Dana L Hood—Salesman, Morton Salt Co, New Orleans, La.

Shuichi Kan—Mgr of Rayon Textiles Dept, Yamatogawa Dyeing Works, Osaka, Japan.

Saburo Ogino—Pres, Nikko Trading Co, Inc, New York, N Y.

Mario Raspino—Chemist, Lima, Peru.

John D Scott—Asst dyer, Georgia Rug Mill Inc, Summerville, Ga.

John Tillett, Jr—Salesman, Calco Chemical Div, American Cyanamid Co, Charlotte, N C.

STUDENTS

Clyde C Lunsford, Jr—Georgia Institute of Technology. Sponsor: C A Jones

Luis F Medina—New Bedford Textile Institute. Sponsor: F Tripp

Theodore P Murphy—New Bedford Textile Institute. Sponsor: F Tripp

Vilayat H K Durrani—North Carolina

(Concluded on Page P369)

175th GENERAL RESEARCH COMMITTEE MEETING

April 17, 1953
Hotel Statler, New York, N Y

THE 175th meeting of the General Research Committee was held in the Sky Top Room of the Hotel Statler, New York, N Y, on Friday, April 17, 1953.

Charles Dorn, Chairman, opened the meeting at 1:30 pm after which he introduced Leonard S Little, Chairman of the Executive Committee on Research, who presented the highlights of ECR's activities. Special reference was made to the very successful meeting held March 12 at the Downtown Athletic Club during which GRC's complete program was examined critically. It was reported that Bulletin No. 4 had been sent to the corporate membership in April. Bulletin No. 5, currently being issued, is a presentation of the activities of the Association complete with photographs of committee activities. Mr Little pointed out that the Executive Committee budget, which has been submitted to the Appropriations Committee, calls for about the same expenditures as last year. He further pointed out that there has been some sentiment for an award which would recognize outstanding effort on the part of committee members, and asked for suggestions as to suitable forms of such recognition.

Following Mr Little's report, Mr Dorn announced the appointment of seven new members to the General Research Committee:

Harley Y Jennings
Jules Labarthe, Jr
Linton G Ray, Jr
Frederick T Simon
Robert L Stutz
John F Warner
Jackson A Woodruff

He then turned the meeting over to H W Stiegler, Director of Research.

Dr Stiegler outlined the progress of activities at Lowell, pointing out that the research personnel are busy on work for the following committees:

FLAMMABILITY —— A new swivel design for the sample holder in the flammability tester designed by Fire Chief Yocker of California is under investigation. It is expected that one of these new holders will be constructed at Lowell, although other designs of holders will be checked at the same time. No change is anticipated unless definite advantages are demonstrated. An article by E P Johnstone on the subject, recently published in the *American Dyestuff Reporter*, was mentioned.

FIBER ANALYSIS——The several methods worked out by the committee are being checked at Lowell.

GAS FADING.

DRY CLEANING.

SHRINKAGE —— Samples for six interlaboratory tests are being prepared.

LIGHT FASTNESS —— New samples of the Blue Standards are being prepared by the Wanskuck Mills.

Dr Stiegler also reported that the Viscose Fellowship is active with the recipient at present engaged in trying to speed the shrinkage test. When this matter has been disposed of the study will return to the dimensional change meter. It was pointed out that Lowell is testing fabrics and materials for Testfabrics to insure that they are suitable for intended tests. Lowell is also engaged in liaison activities with ASTM. Dr Stiegler concluded his initial remarks with an announcement that the Philadelphia Section has appointed a Steering Committee to follow the program at the Philadelphia Textile Institute on high-temperature dyeing.

Mr Dorn read a letter from the Canadian Association of Textile Colourists and Chemists, which stated that the Quebec Section is seeking speakers on textile subjects for their regular period from October, 1953 to April, 1954. If such time is not convenient, they would be glad to consider speakers between April and October of 1954.

Dr Stiegler then proceeded to the regular committee reports.

EVALUATION OF DURABLE FINISHES

A D Nute reported for the subcommittee on Evaluation of Durable Finishes, which has recommended the incorporation of its tentative standard in the *Yearbook*. Members of the committee have gathered new data on crease-resistance at 90% R H ——95°F, which have correlated well with previous results. The committee has accepted a tentative standard for wash fastness of durable, deeply embossed cotton fabrics and will poll the membership of the General Research Committee.

In answer to a question by Mr Dorn relative to progress on the problem of crease retention (previously assigned to this committee), Mr Nute advised that nothing had been done up to that time because the committee had been adhering to the present program in hopes of coming to an early conclusion. Mr Little suggested the expansion of the committee to cover a broader field under the present title. Discussion brought out the fact that much remained to be done in this field in the near future. It was suggested that the work might be expedited by joint activity with other committees.

CONTINUOUS WOOL SCOURING

E A Leonard, Chairman of the subcommittee on Continuous Wool Scouring, reported that a method developed by this committee has been prepared for publication in the *American Dyestuff Reporter*. He further reported that a method had been developed which will supplement that currently in the *Yearbook*. It was recommended that, since the program had been completed, the committee be made placed in the reference category.

BLEACHING

T E Bell, Chairman of the subcommittee on Bleaching, advised that this committee also had decided to restrict its program somewhat in order to arrive at definite conclusions during 1953. It was pointed out that the bulk of the work being eliminated represents duplication or overlapping with the activities of other committees. The work on fluidity has been completed and the methods are being written up for a tentative standard which will be submitted to the General Research Committee for ballot. The Cuen method will be recommended with the cuprammonium method of secondary importance. A formal report was promised at the next meeting. The committee announced its intention to measure the characteristics of the bleached (but unfinished) cloth. They also announced that they are in a position to check ISO changes as soon as they are known. Dr Stiegler and Mr Dorn stated that they will resolve conflicts with other committees. Mr Little encouraged the committee to proceed in setting up standard methods and to let any changes which may be occasioned by ISO activities come in due course.

STREAM POLLUTION

P Theel, Chairman of the subcommittee on Stream Pollution, reviewed the work done so far. Three case histories have been written up, as well as a glossary of terms and a study of test methods, all of which

will be presented for publication to the *American Dyestuff Reporter*. The Piedmont Section is busy on the bibliography. Additional projects will be assigned to the subcommittees of other sections. Mr Little inquired as to whether the work of this committee could furnish data for distribution to corporate members, possibly by November. This would require that the information be available not later than October 1.

COLORFASTNESS TO LIGHT

M J Babey, Chairman of the Subcommittee on Colorfastness to Light, stated that a complete report had been prepared giving data on comparative sunlight and Fade-Ometer tests of selected dyed-manufactured-fiber samples. (The report was circulated to those attending.) Temperature of exposure appeared to be a very important factor and the committee recommended that Fade-Ometers be maintained at temperatures not exceeding 175° F. The committee is starting a yearly comparison between sunlight exposures made between the hours of 9 am and 3 pm and the European concept of daylight exposure, which exposes the samples continuously for the full 24 hours.

SIMPLIFIED CONTROL TESTS

T G Hawley, Chairman of the Subcommittee on Simplified Control Tests, reported that the committee is at present active on the development of a simplified test to indicate the resistance of dyed acetate to the influence of gas-fume fading. At present it is employing a method wherein a pad is saturated with a sodium nitrite solution, plus a little thickener, which is placed over the sample; a few drops of a 1% solution of phosphoric acid are then dropped onto the pad and the pad is covered with an electric iron at low heat. Results appear to check well among the various laboratories and at Lowell.

ANTISTATIC FINISHES

In the absence of K H Barnard, chairman, Dr Stiegler read the report of the Subcommittee on Antistatic Finishes. The committee has agreed on a rough draft of a tentative method for measuring surface resistivity giving a quantitative measure of one factor that governs static resistivity in textiles. When agreement on this method is secured the committee will investigate the static properties of a textile through dynamic means. Samples for further checking are still being circulated. S N Glarum is secretary of this committee.

STANDARD SOILS

G Wiseman reported progress on the work of the Subcommittee on Standard Soils. Dr Stiegler added that the committee has finished part of its work and is planning to look into the matter of preparing standard soil fabrics of the new fibers, such as dynel.

VISUAL AIDS FOR EVALUATING COLOR DIFFERENCES

In the absence of Chairman C J Monego, Dr Stiegler read the report of the Subcommittee on Visual Aids for Evaluating Color Differences. This committee has prepared a limited number of color charts but has deferred final evaluation in order to permit other committees to evaluate the gray scales, which have enjoyed so much popularity abroad recently.

RESISTANCE TO ABRASION

N W Winkler reported progress by the subcommittee on Resistance to Abrasion.

At this point Mr Dorn asked for a quick review of the discussion on March 12 at the Downtown Athletic Club. E A Leonard gave a résumé of the first section of the meeting dealing with the objectives of AATCC research, which lead to the conclusion that AATCC should be uniform in approach in all its test methods; it should attempt an added interpretation of the test, permitting some recognition of its significance, but should not attempt end use specifications. The second section of the discussion was reviewed by C A Sylvester, and it was noted that some of the items dealing with the organization of AATCC research had already been taken care of through the activities of the Committee on Revision of Bylaws. The third section was reviewed by A E Johnson.

Under new business, W A Holst inquired about the AATCC Stoving Test. He finds that there is neither an active nor a reference committee; that the standard test, as given in the *Year book*, appears to be incorrect because the color used does not actually pass the test. It appears that this test will have to be re-examined.

The meeting adjourned at 3:50 p m.

Those present included:

C W Dorn, *Chairman*

H W Stiegler, *Research Director*

G H Schuler, *Secretary*

L S Little, *Chairman of Executive Committee on Research*

R C Allison, W D Appel, E C Atwell, M J Babey, G L Baxter, T E Bell, H C Chapin, P J Fynn, R C Geering, T G Hawley, Jr, A E Hirst, W A Holst, K A Howry, A I Hultberg, R W Jacoby, H Y Jennings, A E Johnson, N A Johnson, E A Leonard, W R Moorhouse, J E Norton, A D Nute, B A Ryberg, A E Sampson, C H A Schmitt, J H Skinkle, F T Simon, H G Smith, R B Smith, R H Souther, E I Stearns, C A Sylvester, P Theel, F Tripp, M W Winkler, P J Wood, H L Young.

Membership Applications

(Concluded from Page P367)

State College. Sponsor: H A Rutherford

Stuart D Snyder—Philadelphia Textile Institute. Sponsor: W H Hughes

Robert J Kunik—Philadelphia Textile Institute. Sponsor: W H Hughes

Harold Anenbery—N Y State Institute of Applied Arts & Science. Sponsor: H C Morran

Louis Berman—N Y State Institute of Applied Arts & Science. Sponsor: H C Morran

Francis V Pappalardo—N Y State Institute of Applied Arts & Science. Sponsor: H C Morran

Melvyn Rothman—N Y State Institute of Applied Arts & Science. Sponsor: H C Morran

Ronnie Schapow—N Y State Institute of Applied Arts & Science. Sponsor: H C Morran

CORPORATE

The Orr Felt & Blanket Co, Princeton Hosiery Mills, Prospect Chemical Company, The Roxborough Company, Fred Whitaker Co, Inc.

APPLICATION FOR TRANSFER TO SENIOR MEMBERSHIP

Newton A Teixeria, Arnold Silver, Richard N Combs.

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Mid-West Section Meeting Report

April 18, 1953

Netherland Plaza Hotel, Cincinnati, Ohio

THE spring meeting of the Mid-West Section was held at the Netherland Plaza Hotel, Cincinnati, Ohio, on April 18, 1953.

The afternoon meeting was called to order at 2:30 by vice-chairman John Gordon Stott. The Secretary's and Treasurer's reports were approved as read. Chairman Alfred Olson called for reports from all the chairmen of the various committees.

Joseph H Jones was officially appointed custodian of records of the Section. The meeting was then turned over to R P Monnier who presented a paper "An Introduction to Dyestuff Manufacture."

The afternoon meeting was attended by approximately 125 members and guests, and was adjourned at 4:15.

Dinner was served at 7:15 PM to 131 members and guests who later heard R E Wolfrom present a paper entitled "Some Aspects of Detergency and Detergency Testing."

"THE APPLICATION OF VAT DYES"

Monograph No 2

American Association of Textile Chemists and Colorists

MONOGRAPH NO 2, dealing with "The Application of Vat Dyes" has been prepared by a Board of Editors and Collaborators in the American Association of Textile Chemists and Colorists. This group represents a complete cross-section of the entire industry so that the text of the Monograph represents latest information both from laboratory and practical plant standpoints.

The Monograph contains approximately 385 pages with contents of various chapters as follows:

I *HISTORY*—Natural Indigo and Tyrian Purple; Development of Synthetic Vat Dyestuffs; History of Application of Vat Dyes; The Application of Vat Dyes to Fibers Other Than Cotton.

II *PRINCIPLES OF VAT DYE APPLICATION*—Types and Forms of Vat Dyes in Commerce; Chemistry of Application; Stripping and Redyeing Faulty Vat Dyeings; Fastness; Print Discharges; Change of Shade in Artificial Light; Dichroic Dyes.

III *APPLICATION TO COTTON RAW STOCK*—Equipment Used; Methods of Color Application; Typical Examples.

IV *APPLICATION TO COTTON SKEINS*—Equipment and Methods.

V *APPLICATION TO COTTON WARPS*—Short Chain Method; Long Chain Warp Dyeing; Continuous Pigment Padding Method.

VI *APPLICATION TO COTTON PACKAGES*—The Package; Package Dyeing Machines; Chief Factors in Dyeing Packages with Vat Dyestuffs; Dyeing Speed and Levelling Power of Vat Dyes; Dyeing Methods; Oxidation and Finishing; Vat Dyeing on Beams; Illustrative Dyehouse Procedures.

VII *APPLICATION TO COTTON PIECE GOODS*—History; Jig Methods; Padding Methods; Continuous Methods; Overhead Reel Method; Vat Dyeing of Cotton Narrow Fabrics.

VIII *HOSIERY*—Application of Colors to Cotton Hosiery; Application of Colors to Mixed-Fiber Hosiery.

IX *APPLICATION TO FIBERS OTHER THAN COTTON*—Vat Dyeing of Viscose Rayon; Vat Dyeing of Cellulose Acetate; Vat Dyeing of Nylon; Vat Dyeing of Animal Fibers.

X *GENERAL PRINCIPLES OF PRINTING*—Piece Goods; Forms Other Than Piece Goods.

XI *PRINTING*—Direct Printing with Vat Dyestuffs; Discharge Printing with Vat Dyestuffs; Goods Dyed After Printing.

XII *INDIGO*—History and Properties; Various Indigo Vats and their Preparation; Dyeing of Cotton with Indigo; Dyeing of Wool with Indigo; Application of Indigo to Cotton Printing; Indigo Derivatives.

XIII *THE USE OF VAT DYES AS PIGMENTS OR IN NONTEXTILE APPLICATIONS* — Paper; Rubber, Plastics and Resins; Fireworks; Paints and Lacquers; Resin-Bonded Pigments; Miscellaneous.

XIV *LEUCOESTERS OF VAT DYESTUFFS*—History and Chemistry; Properties; Application of Leucoesters; Light Fastness of Leucoesters; Relative Costs of Vat and Soluble Vat Dyeing.

XV *TABULATION OF VAT DYESTUFFS*—Formulae and Properties; Numerical Index; Alphabetical Index; Trade Names of American-Made Vat Dyes.

AUTHOR INDEX
SUBJECT INDEX

From the foregoing, it is seen that this Monograph gives a very comprehensive description of all of the factors involved in the application of vat dyes. In all discussions of application procedure, practical working formulas are given. This publication is, undoubtedly, of interest to all persons who are either producers or consumers of vat dyes.

The price of "The Application of Vat Dyes" is $5 per copy, postpaid, to members; to nonmembers it is $6 per copy. Please use the order form at the bottom of this page.

Dr H C Chapin, National Secretary
American Association of Textile Chemists and Colorists
P O Box 28, Lowell, Massachusetts

Enclosed is my check for $..... covering payment of ..... copies of "The Application of Vat Dyes" at $5.00 per copy.

Enclosed is my check for $..... covering payment of ..... copies of "The Application of Vat Dyes" at $6.00 per copy.

Name ..... Address .....

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Hudson-Mohawk Section ——

WATER CONDITIONING FOR THE TEXTILE PLANT*

ESKEL NORDELL
Administrator of Laboratories
The Permutit Company

E Nordell

All natural water supplies contain impurities, the nature and amounts present varying with different waters over a fairly wide range. The principal impurities that may cause difficulties in process work in textile plants are color, turbidity, organic matter, microorganisms, iron, manganese, hydrogen sulfide and hardness. Color, turbidity and most organic matter may be removed by coagulation, settling and filtration. Microorganisms may be killed by chlorination and algae in reservoirs, by treatment with copper sulfate. Iron and/or manganese, present as the "ous" bicarbonates, may be removed 1) by aeration, settling and filtration, 2) by cation exchange or 3) by filtration through Manganese Permutit. If present in organic or colloidal form, iron and/or manganese may be removed by coagulation, settling and filtration. Hydrogen sulfide may be reduced 1) by aeration or 2) by passing through scrubbed flue gas followed by aeration. Remaining residuals may be oxidized to sulfate by chlorination. Hardness may be reduced or removed by 1) zeolite (sodium-cation exchanger) process, 2) hydrogen-cation exchanger process, 3) cold lime-soda process, 4) combination lime-zeolite process, 5) hot lime-soda process, 6) two-stage hot lime-soda sodium-cation exchanger process. Complete removal of mineral matter may be effected by the ion-exchange demineralization process.

NATURAL WATERS

ALL of our fresh water supplies are derived from moisture precipitated from the atmosphere as rain, snow, sleet or hail. As these *meteoric waters* fall through the atmosphere, they come in contact not only with the gases of which the atmosphere is composed but also with dust, soot and other suspended impurities. Some of these materials are dissolved and others are carried along as suspended matter.

Therefore, these meteoric waters, even before they strike the earth's surface, contain both dissolved and suspended impurities. Analyses of rain hail, sleet and snow, as shown in Table I, have proven this. In fact, some rain waters have been found to contain as much as 12 grains of mineral matter per gallon.

In general, however, rain water is rather low in mineral matter, ranging from about 1 to 5 grains per gallon. This mineral matter varies in nature dependent on the particular area in which the rain fell and the amounts and nature of the suspended matter in the atmosphere. The soluble matter, for instance, in rain water, falling in mid-ocean, has been found to be largely common salt.

In other localities, lime and magnesium compounds are most prevalent. Compounds of ammonia are also common. In cities, sulfuric acid is often found. This is due to the sulfur content of the gases formed by burning coal. The winter rot of clothes in certain sections is caused by laundering in this acid rain water.

SURFACE WATERS —— When rain strikes the ground, it comes in contact with the various minerals of which the earth's crust is composed. Some of these, such as granite, shale, quartz, etc, are relatively insoluble. Therefore, the surface waters, that is, the brooks, rivers, ponds and lakes in regions composed mainly of such materials, are found to be relatively low in mineral content. On the other hand, if the rocks of a certain area are relatively soluble in nature, as is the case with gypsum, limestone, dolomite, etc, then the waters in such a region will contain much more mineral matter.

TABLE I

ANALYSES OF VARIOUS METEORIC WATERS

Expressed as ppm of $CaCO_3$

	Hardness	*Sodium*	*Ammonium*	*Alkalinity*	*Acidity*	*Chlorides*	*Sulfates*	*pH Value*
RAIN								
DeLand, Florida	31	12	—	24	—	15	4	7.0
Hamilton, Bermuda	34	32	—	33	—	28	5	—
Holmes, New York	20	9	—	18	—	1	10	6.6
London, England (first rain)	43	11	3	19	—	10	27	—
London, England (after 22 hrs)	8	—	5	5	—	5	3	—
Mid-Ocean	15	30	—	10	—	30	6	—
RAIN, ACID								
London, England	8	—	4	—	20	27	5	3.5
Yorkshire, England	24	10	5	—	4	15	28	4.1
HAIL								
London, England	28	—	3	4	—	10	17	—
SLEET, ACID								
London, England	15	7	—	—	10	22	10	3.7
SNOW								
Cos Cob, Conn	3	2	1	4	—	1	—	6.6
London, England	13	—	—	—	—	17	22	—
SNOW, ACID								
Birmingham, N J	4	—	1	—	1	2	3	4.7
London, England	15	5	2	—	4	17	9	4.1

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* Presented before the Hudson-Mohawk Section in Albany, N Y, on February 6, 1953. E Nordell is the author of Water Treatment for Industrial and Other Uses, Reinhold Publishing Corporation.

TABLE II

MAXIMUM AND MINIMUM COLOR OF HIGH-COLOR SURFACE WATERS*

Name and Location	Color in ppm High	Low
Black River, Georgetown, S C	180	100
Caloosahatchie Canal, Moorehaven, Fla	240	45
Calumet River, East Chicago, Ill	120	15
Charles River, Shannock, R I	100	50
Chuctanunda Creek, Amsterdam, N Y	160	25
Cuyahoga River, Cleveland, O	160	15
Dan River, South Boston, Va	90	9
Edisto River, Charleston, S C	300	60
Fox River, Green Bay, Wisc	100	30
Great Dismal Swamp, Elizabeth City, N C	1200	150
Haw River, Burlington, N C	300	50
Hyco River, Denniston, Va	60	4
James River, Buchanon, Va	200	15
Lac Dufault, Quebec, Can	70	40
Nottaway River, Stony Creek, Va	50	8
Ogeechee River, Eden, Ga	110	25
Rancocas Creek, Birmingham, N J	170	30
Roanoke River, Randolph, Va	60	5
Satilla River, Waycross, Ga	130	50
Willis River, Flanagan Mills, Va	50	20

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TABLE III

MAXIMUM AND MINIMUM TURBIDITIES OF RIVERS OVER A ONE-YEAR PERIOD*

Name of River	Sampled at or near	Turbidities in ppm Maximum	Minimum
Alabama	Selma, Ala	325	25
Allegheny	Kittanning, Pa	65	2
Cahaba	Birmingham, Ala	265	5
Chattahoochie	West Point, Ga	450	15
Cumberland	Nashville, Tenn	425	28
Delaware	Lambertville, N J	90	1
Grand	Grand Rapids, Mich	375	3
Hudson	Hudson, N Y	39	4
Illinois	LaSalle, Ill	1610	10
James	Richmond, Va	400	6
Lehigh	South Bethlehem, Pa	50	1
Missouri	Kansas City, Kans	5350	35
Monongahela	Elizabeth, Pa	350	9
Oostanula	Rome, Ga	415	4
Peedee	Peedee, S C	375	15
Potomac	Cumberland, Md	280	3
Raritan	Bound Brook, N J	272	4
Wabash	Logansport, Ind	900	5
Wateree	Camden, S C	960	10
Youghiogeny	McKeesport, Pa	1600	3

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TABLE IV

MAXIMUM AND MINIMUM TURBIDITIES OF LAKES OVER A ONE-YEAR PERIOD*

Name of Lake, Pond or Reservoir	Sampled at	Turbidities in ppm Maximum	Minimum
Auburn	Auburn, N Y	30	1
Cayuga	Seneca Falls, N Y	100	0
Erie	Buffalo, N Y	250	4
	Cleveland, O	115	1
	Erie, Pa	72	2
	Monroe, Mich	1250	10
Hemlock	Rochester, N Y	11	1
Kampeska	Watertown, N Y	115	50
Kilby	Portsmouth, Va	55	4
Michigan	Evanston, Ill	75	4
	Hammond, Ind	75	1
	Michigan City, Ind	80	3
	Sheboygan, Wis	190	3
Oneida	Butler, Pa	160	2
St Marys	Eveleth, Minn	30	5
Salem	Winston-Salem, N C	2000	15
Spavinaw	Tulsa, Okla	50	3
Wichita	Wichita Falls, Tex	500	15

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The surface waters of New England, for example, originating as they do in areas composed of relatively insoluble rocks, are usually low in mineral content. The surface waters of the Middle West, though, are usually quite high in mineral matter, for these waters originate in regions composed of more soluble rocks. In addition to their content of dissolved minerals, surface waters may contains very appreciable quantities of suspended insoluble matter, such as silt. Also, especially if they originate in swampy areas, surface waters may contain a considerable amount of color and other organic matter.

GROUND WATERS——On the average, about one-third of the rain that reaches the earth seeps into the ground. During its passage, this water comes into very intimate contact with the minerals of the earth's crust. Furthermore, since the movement of ground water is relatively slow, it is in longer contact with this mineral matter than is the case with surface waters.

Because of this longer and more intimate contact, ground waters, such as are obtained from springs, wells, infiltration galleries, etc, usually contain much more dissolved mineral matter than the surface waters of the same area. There are exceptions, though, to this general rule. Thus, a river originating in an area of comparatively soluble rocks may later flow through an area of comparatively insoluble rocks. In such cases the surface waters in this second area may contain more mineral matter than the ground waters.

WATER IMPURITIES

The principal impurities which may cause difficulties in process water in textile plants are color, turbidity, organic matter, microorganisms, iron, manganese, hydrogen sulfide and hardness.

COLOR——Color in water is due to organic matter, and most highly colored waters are surface waters from swampy areas. Some shallow wells and an occasional deep well may also have high color. As shown in Table II, the color of a surface water varies during the year over a fairly wide range, so that the maximum color with some waters may be over 10 times as high as the minimum color. Color is very objectionable in most process waters and, for most uses, should not exceed 10 ppm; for special uses the tolerance may be as low as 5 ppm.

SEDIMENT AND TURBIDITY—— Suspended insolubles, if coarse enough to settle out rapidly, are usually classified as sediment, while the finer material, which tends to stay in suspension, is termed tur-

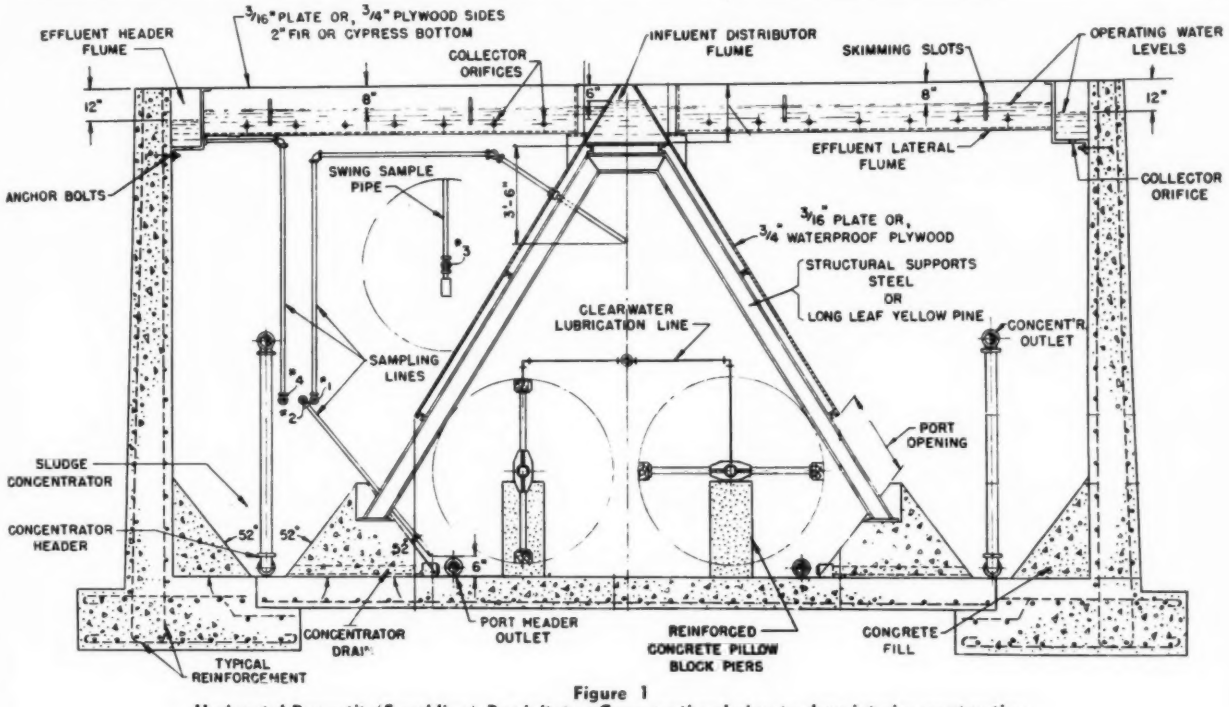


Figure 1
Horizontal Permutit (Spaulding) Precipitator. Cross-sectional view to show interior construction.

bidity. Sediment and/or turbidity are common in surface waters but, because of filtering effect of the strata through which ground waters pass, are usually not present in ground waters, although there are some exceptions. As shown in Table III, the turbidities of streams vary during the year over such a large range, that the maximum turbidity in some cases may be several hundred times the minimum turbidity. While we are inclined to think of lake or reservoir waters as being uniformly clear, temperature changes and storms can cause very appreciable variations in turbidity during the year, as is shown in Table IV. Tolerances for turbidity vary somewhat according to the nature of the turbidity as well as the process but for most uses should not exceed 5 ppm and should be less than 2 ppm for special uses.

ORGANIC MATTER —— Waters containing much organic matter are usually high in color and, as stated under "Color", are usually surface waters which have originated in swampy areas. Other organic matter may be due to living or dead microorganisms, such as algae, crenothrix, slimes, etc. Organic matter may cause a variety of staining and spotting troubles and develop objectionable tastes and odors.

MICROORGANISMS —— Microorganisms are common in surface waters but are usually either absent or low in amount in deep well waters. They may be either pathogenic or nonpathogenic. Algae, crenothrix, slimes, and many other varieties are very troublesome in mill water causing stains, slime spots, clogging and development of objectionable tastes and odors.

TASTES AND ODORS —— Tastes and odors are usually due to microorganisms, the decomposition of organic matter or trade wastes. They are common in stagnant surface waters and waters contaminated by trade wastes. Ground waters, with the exception of sulfur waters, are usually free from or low in tastes and odors, especially if from deep wells.

IRON——Iron in the form of soluble ferrous bicarbonate is found in many deep well waters. On coming in contact with air, the iron is oxidized to insoluble ferric hydroxide, forming yellowish to reddish brown stains and precipitates. In surface waters, iron is often found in an organic or colloidal form. Iron is an extremely objectionable constituent in all process waters, and tolerances should be 0.1 ppm and not the 0.3 ppm so often given in the literature.

MANGANESE——Manganese occurs in similar forms to iron, that is, in deep well waters it occurs as soluble and colorless manganous bicarbonate, while in surface waters it may occur as organic or colloidal manganese. It is even more objectionable than iron in all process waters, but, fortunately, it is much rarer than iron in occurrence. For some process uses the tolerance for manganese is 0.1 ppm and for special uses 0.05 ppm.

HYDROGEN SULFIDE —— Hydrogen sulfide is found in some well waters—— the so-called sulfur waters——and it may also result from the reducing action of certain bacteria on sulfates. It is very corrosive to metals, has a characteristic "rotten-egg" odor and, even in small concentrations in the air, is extremely poisonous, being in fact, worse than hydrocyanic acid. Because of its corrosive qualities, the tolerance for hydrogen sulfide should be zero ppm.

HARDNESS —— Practically all natural water supplies contain some hardness, but the amounts present in various fresh water supplies cover a large range——from a few ppm to over 2000 ppm. The great majority of usable waters, however, will range under 500 ppm. In a given area, surface waters usually are lower in hardness than ground waters, but there are exceptions.

Hardness is principally noted for its soap-destroying and scale-forming tendencies. Soap reacts with hard water to form insoluble lime and magnesia soaps, and these have a tendency to stick to everything with which they come in contact. Alkalis react with hard water to precipitate cal-

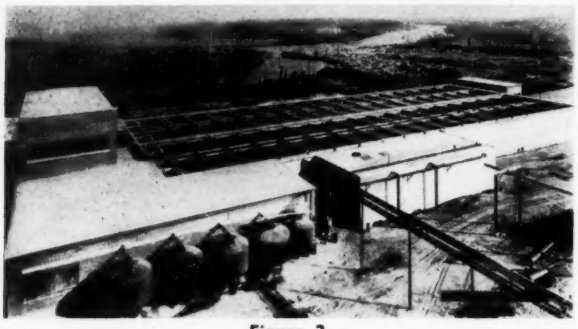


Figure 2
Horizontal Permutit (Spaulding) Precipitators. Installation for removing turbidity and color from a river water.

Figure 3
Permutit Floc-Former. Installation in a Southern textile plant.

cium carbonate and magnesium hydroxide, and the calcium carbonate especially tends to stick to and coat everything with which it comes in contact.

Practically all untreated natural water supplies form scale and sludge when evaporated in the steam boiler, and therefore all boiler feed water requires treatment. And most hard waters also form scale in water heaters, hot-water piping, valves and fixtures. Scale formation in such locations results in inefficient heat transfer, reduced flow rates and increased costs for labor, repairs and replacements.

Hardness is also exceedingly troublesome in practically all textile wet-processing operations, the only exceptions possibly being those carried out in acid solutions. In cotton processing, for instance, hardness causes objectionable deposits in kier boiling, reacts with the caustic in mercerizing and the chemic in bleaching to form deposits and causes uneven dyeing especially with the substantive dyes, "Indanthrene" or other vat dyes. With wool, its fir cone structure offers marvelous lodging places for the insoluble lime and magnesia soap curds formed by scouring in hard water, and these cause difficulties not only in subsequent wet processing, such as stock dyeing, bleaching and piece dyeing, but also in some mechanical processes, such as carding. Hardness also offers numerous difficulties in silk processing from soaking and degumming through weighting, bleaching and dyeing. As for rayon and the other synthetic fibers, tolerances for hardness are even stricter than for other textile operations.

WATER PURIFICATION

REMOVAL OF TURBIDITY AND COLOR——The coagulation of waters for the purpose of removing color, turbidity, microorganisms or other organic matter is best carried out in a Permutit Precipitator or Floc-former.

PERMUTIT (SPAULDING) PRECIPITATOR——Figure 1 is a cross-sectional drawing of a horizontal Permutit (Spaulding) Precipitator, and Figure 2 is a view of an installation used for removing color and turbidity from a river water. In the Precipitator, the raw water enters the central mixing section, where the chemical is introduced and mixed with the water. A large, tough floc is produced by controlled agitation as the water passes downwardly through it.

Emerging through ports in the bottom of this inner section, the water then rises and is settled and filtered through a predetermined depth of previously formed sludge in the outer section, which is so designed that the cross-sectional area increases steadily from bottom to top. The increasing cross-sectional area results in decreasing steadily the vertical velocity of the water as it rises from the bottom to the draw-off trough in the upper part of this chamber. This decreasing upward velocity permits the water to reach a plane at which its velocity is so low that it leaves the sludge behind. In practice, this is found to constitute a clean plane of demarcation between the sludge and the settled water.

Because of the intimate contact of water with precipitates afforded in this type of equipment, the maximum adsorptive and straining effect of the coagulum is fully utilized. While the detention periods in the old types of settling tanks and basins were usually from four to six hours, the detention period in the Precipitator (because of its high efficiency) is usually only 60 to 70 minutes. Therefore, the ground space occupied by the Precipitator need be only a fraction of that required for the older types of equipment. Where required, the settled effluent from the Precipitator may be further clarified by passage through filters.

PERMUTIT FLOC-FORMER——Figure 3 is a photograph of another type of coagulation and settling equipment, the Floc-former. In this installation, the Floc-former compartments are on the left-hand side and the settling basin is on the right-hand side. The raw water, on entering the first chamber of the Floc-former, is speedily and thoroughly mixed with the chemicals from the chemical feeds, which may be situated either at ground level and the chemicals pumped to the Floc-former, or on top of the Floc-former and the chemicals discharged directly into it.

The treated water then flows successively through the other chambers, each of which is fitted with agitators rotating at a speed controlled to furnish a gently agitated rolling mix. The speed of agitation is regulated so as to yield a large, tough and easily settled floc. Too low a speed of agitation results in a poorly formed floc, while too high a speed tends to break up the floc particles.

From the last of the Floc-former compartments, the coagulated water enters a baffled settling basin where the bulk of the floc, plus its load of entrained turbidity and color, settles to the bottom, from which it is discharged through a sludge-removal system. Final clarification is effected in filters following the settling basin.

FILTERS——Sand filters usually are employed following the coagulation and the settling processes. Their function is to remove any insoluble material which has not settled out of the coagulated and settled water and thus to furnish a clear, clean, bright and colorless effluent. The filter medium that is most widely employed is sand, hence the name *sand filter*. However, crushed and graded anthracite has also come into favor as a filter medium.

Because of the use of coagulants, the old English, or slow, sand filter has practically disappeared and has been replaced by the American, or rapid, filter. These may be divided into two classifications: the *pressure* type and the *gravity* type. In the pressure type, the container for the filter media is a closed steel shell designed for whatever pressures are required. In the gravity type, the container for the filter media is an open concrete, wood, or steel shell.

Figure 4 illustrates a horizontal pressure-type sand filter. The standard diameter for

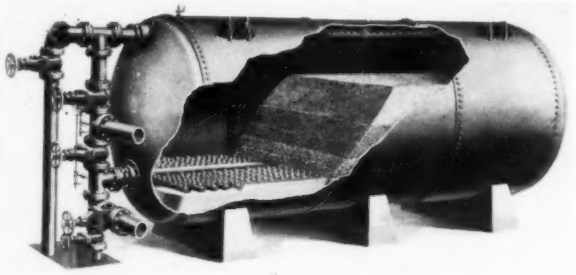


Figure 4
Horizontal pressure-type filter. Cutaway to show interior construction
(Courtesy of The Permutit Company)

Figure 5
Gravity-type filter. Operating floor in a Southern textile plant.
(Courtesy of The Permutit Company)

these shells is 8 feet and they vary in length up to 25 feet. Where smaller flow rates are to be accommodated, vertical shells are employed varying up to a maximum of 10 feet in diameter.

Figure 5 illustrates concrete gravity-type sand filters. Wood and steel shells are employed occasionally for gravity filters, but usually the shell is made of concrete and also in the form of a rectangular box. Gravity filter units are almost invariably mounted so as to discharge into a clear well, from which the water is pumped to service——the well also serving to supply filtered water for backwashing.

While the gravity filter differs in details of design from pressure filters, the principles and methods of operation are much the same. With gravity filters, however, backwashing is performed following the building up of a much lower pressure differential.

Coagulation, settling, and filtration, when properly carried out, will remove turbidity, color, colloidal suspensions, organic iron and/or manganese and will effect large reductions in microorganisms. These processes, however, do not remove soluble mineral matter, and therefore the hardness content of a water is just as great after as before filtration.

Chlorine is the most widely used disinfectant for killing organic growths. It may be applied before other treatments——prechlorination; after——postchlorination; or both before and after. In open reservoirs or ponds copper sulfate is commonly used to kill algae growths.

IRON AND MANGANESE REMOVAL ——Iron and/or manganese, when present as the soluble bicarbonates, may be removed 1) by aeration, settling and filtration, 2) by the zeolite water softener or 3) by filtering through Manganese Permutit. In method 1), the water is first passed through an aerator where sufficient air is dissolved to oxidize the iron or manganese. Is is then caught in a catch basin or settling basin where the great bulk of the insoluble, hydrated oxides is settled out, after which passage through a filter removes the rest. In the case of iron, it is only occasionally necessary to add alkali or lime to the aerated water in order to speed up the reaction, but, in the case of manganese, it is always necessary. Figure 6 illustrates a municipal iron-and-manganese-removal and water-softening plant of the Precipitator type.

The second method is of value only when the water is to be completely softened by the zeolite process. In that case, iron and/or manganese impurity is removed by the zeolite simultaneously with the removal of the hardness. The third method is usually employed only with waters containing 1 ppm or less of iron or manganese. In this method, the water is passed downwardly through a bed of Manganese Permutit, which oxidizes the iron or manganese to the insoluble hydrated oxides, and these are removed by the filtering action of the bed. The accumulations of oxides are removed by periodic backwashings, and, when required, the oxidizing power of the bed is restored by regeneration with potassium permanganate.

The above methods are used for removing ferrous and/or manganous bicarbonates from ground waters. In surface waters, iron and/or manganese may occur in colloidal or organic forms, which cannot be removed by any of the above methods. However, iron or manganese in such forms can be removed by careful coagulation, settling and filtration.

REMOVAL OF HYDROGEN SULFIDE ——The removal of hydrogen sulfide from waters containing relatively small amounts is usually accomplished by aeration and detention, followed by chlorination to oxidize any residuals. However, if the content of hydrogen sulfide is more than a few ppm or if the alkalinity is high, then other methods may be required since aeration of such waters usually results in removing the free carbon dioxide and in raising the pH value so that the remaining sulfide is mostly present as an alkaline or alkaline-earth sulfide.

Such waters may be treated with flue gas in an aerator with enclosed sides. The carbon dioxide in the flue gas lowers the pH, liberates the hydrogen sulfide, and the great bulk of it is discharged with the spent flue gas. The carbon dioxide is then removed by allowing the water to fall through an open aerator, after which any residual sulfide may be removed by chlorination.

REMOVAL OF TASTES AND ODORS ——With the exception of hydrogen sulfide, the removal of which has been discussed in the preceding paragraphs, the disagreeable tastes and odors that may be present in some waters are usually organic in nature. These may be due to decaying vegetation, algae, crenothrix, or other microorganisms or may be due to trade wastes or their reaction products on chlorination. Paradoxically enough, some of these malodorous products formed by chlorinating to a slight residual may be destroyed by superchlorination.

Aeration is usually quite effective in reducing odors even though it may not completely remove them. It may be followed by treatment with activated carbon. Where coagulation and settling is practiced, the activated carbon in powdered form is added to the water as it enters the coagulation and settling equipment. Another method of use is to pass the water through filters in which a granular activated carbon constitutes the filter bed.

REMOVAL OF HARDNESS——WATER SOFTENING————The softening of process water in textile plants is almost universally accomplished by use of the zeolite or sodium-cation-exchanger process. This may be preceded by coagulation, settling and filtration, by iron and/or manganese removal or, in some cases, by a partial softening with lime.

Very often one central zeolite water-softening plant softens not only the process water but also the boiler feed water and water for other uses. In other cases, the boiler feed water is treated separately by

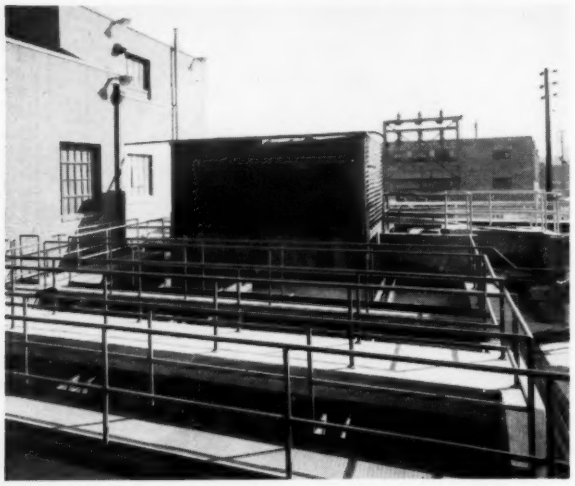


Figure 6
Municipal iron-and-manganese-removal and softening plant of Permutit (Spaulding) Precipitator type. Aerator in middle background.

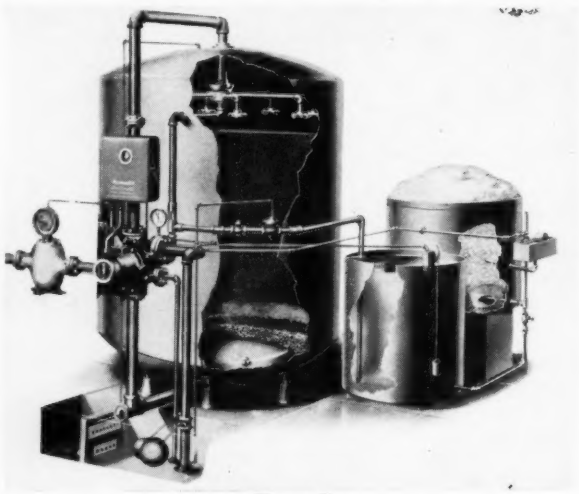


Figure 7
Permutit Automatic Zeolite Water Softener. Cutaway to show interior construction of (l to r): 1) zeolite water softener, 2) brine measuring tank and 3) wet salt-storage tank.

the hot lime-soda process or by the hydrogen-cation-exchanger process. For some special process work, the water may be demineralized by ion exchange.

ZEOLITE (SODIUM-CATION-EXCHANGER) PROCESS——In the zeolite water softener, as shown in Figure 6, water at ordinary temperatures is softened by flow through a bed of a granular or bead-type cation exchanger. As the water comes in contact with the cation exchanger, the hardness is so completely removed by base-exchange action that the resultant effluent is termed *water of zero hardness,* or, more commonly, *zero water.* After a definite amount of hardness has been abstracted, the cation exchanger is treated with a predetermined amount of common-salt brine, which removes the hardness and restores the cation exchanger to its original state.

This process is known as regeneration and consists of three steps: 1) backwashing, 2) salting, 3) rinsing. The backwashing serves to loosen, cleanse and hydraulically regrade the cation-exchanger bed. The salting serves to remove the hardness and to restore the cation exchanger to its original condition. The rinsing serves to remove the excess salt and soluble by-products——calcium and magnesium chlorides——from the bed. These cycles of softening and regeneration may be repeated indefinitely as the wear and tear on the cation exchanger are very slight——usually only about two per cent per year. Therefore, only a slight addition of new material is required annually in order to keep the bed performing at its full rated capacity.

Figures 7 and 8 illustrate the pressure type of zeolite (sodium-cation-exchanger) water softener, which is the type most widely used in the industries. Zeolite water softeners of the gravity type are also available, and these are usually of rectangular concrete construction.

Completely automatic operation may be obtained in either the pressure or the gravity type. In the pressure type, a motor-operated valve is usually mounted on the front of the softener. In the gravity type, a motor-operated pilot valve is employed to operate the hydraulic valves.

In either case, the principle is the same. The water meter on the soft-water line is equipped with an electric contact head and an automatic resetting device. At the end of the softening run an electric current is established, which rotates the valve to the wash position.

The length of the backwash period is governed by an electric time switch. At the end of this period, a current is again established and the valve rotates to the brine position. In this position, a predetermined volume of brine is admitted, this being governed by an electric float switch.

After the brine has been admitted, the valve is rotated to the rinse position. The rinsing period is governed by an electric time switch, and, at the end of this period, the valve is rotated to the soften position, which again places the softener in operation. In the meantime the meter has automatically been reset for the succeeding softening run.

HYDROGEN-CATION-EXCHANGER PROCESS —— In the hydrogen-cation-exchanger process, the exchanger used is either of the carbonaceous or resin type as the siliceous zeolites are unsuitable for use on the hydrogen cycle. In the sodium-cation-exchanger process, the regenerant used is salt, and the softened water contains an equivalent amount of sodium salts, so that the total solids content is not reduced.

In the hydrogen-cation-exchanger process, the regenerant used is an acid, usually sulfuric acid, and in this process the bicarbonates are removed so that the total solids content of the effluent is reduced by an amount equivalent to the bicarbonate or alkalinity content of the raw water. The sulfates and chlorides, however, show up in the effluent as equivalent amounts of sulfuric and hydrochloric acids, and these must be neutralized before use. There are two methods of accomplishing this. One is by neutralization of the aerated or degasified effluent with caustic soda.

The other is by the use of both hydrogen-cation-exchanger unit(s) and sodium-cation-exchanger unit(s), the flows being so proportioned that, when mixed, the sodium-bicarbonate content of the sodium-cation-exchanger effluent neutralizes the acidity of the hydrogen-cation-exchanger effluent and furnishes whatever degree of alkalinity is required. Figure 9 is a photograph of an installation of this type consisting of 1) a hydrogen-cation exchanger, 2) a sodium-cation exchanger and 3) a degasifier to remove the carbon dioxide formed from the bicarbonates in the hydrogen-cation exchanger plus that formed by neutralizing its acid effluent with the sodium-cation-exchanger effluent.

COLD LIME-SODA PROCESS——The cold lime-soda and hot lime-soda water-softening processes are based on precipitation. In these processes the bulk of the hardness is precipitated as calcium carbonate and magnesium hydroxide by adding accurately measured dosages of hydrated lime and soda ash. As indicated by

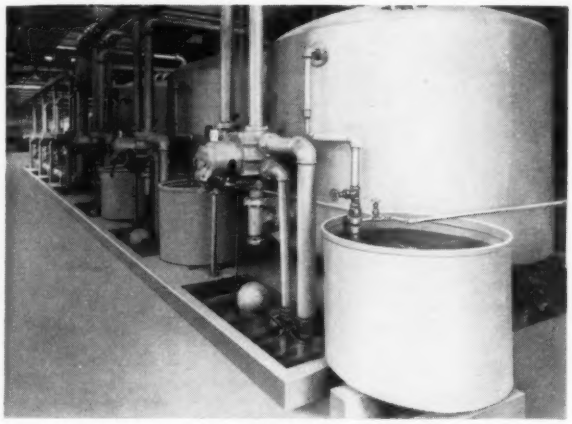


Figure 8
Zeolite water-softener battery in a rayon plant.
(Courtesy of The Permutit Company)

Figure 9
Hydrogen-cation exchanger plus sodium-exchanger water-softening plant.
Left center—hydrogen-cation-exchanger unit.
Center—sodium-cation-exchanger unit.
Right—wood degasifier mounted over catch basin.
(Courtesy of The Permutit Company)

their names, the cold lime-soda process is carried out without warming the water, while in the hot lime-soda process the water is heated to temperatures around the boiling point.

The Permutit (Spaulding) Precipitator, as previously described, is also widely employed for softening water by the cold lime-soda process. Being of the sludge blanket type, it has many advantages over the older or conventional types as it eliminates the danger of "after precipitates", effects economies in the use of chemicals and is well adapted to the removal of silica by the magnesia process. Older types of cold lime-soda water softeners may be converted to this design, thus securing these advantages and also greatly increasing the capacity since the detention period in the Precipitator is only 1 hour as compared with the 2- to 4-hour detention periods in the conventional types.

In the Precipitator the raw water is mixed with properly proportioned amounts of chemicals in the downcomer section and then rises through a suspended blanket of sludge in another section, which is so designed that the cross-sectional area increases upwardly. As the treated water rises through this section, a plane is reached where its diminishing upward velocity is insufficient to raise the sludge any farther. In practice, there is a clear plane of demarcation between the surface of the sludge blanket and the clarified water above it.

The chemicals used may be lime and a coagulent or lime plus soda ash plus a coagulant or, if silica removal is required, dolomitic lime or activated magnesia may be used. In general, the cold lime-soda softener reduces the hardness of a water to about 4 grains per gallon. In railroad practice, however, excesses of chemicals are used, which reduce the hardness to about 1 grain per gallon.

Usually the cold lime-soda water-softener plants use filters to remove all traces of suspended matter, but, in some cases, the filters may be omitted. When a zero-hardness effluent is required, the filtered effluent from the cold process may be passed through zeolite water softeners. This process is usually known as the *combination lime-zeolite process.*

HOT LIME-SODA PROCESS —— The hot lime-soda process is very widely used in softening boiler feed waters. It differs from the cold lime-soda process in that 1) it is carried out at temperatures around the boiling point of water, 2) it reduces the hardness to a greater extent, 3) no coagulant is required, 4) by the use of dolomitic lime or activated magnesia, it removes silica more economically, and 4) a deaeration of the water is effected. Regarding hardness, this may be reduced to less than 1½ grains per gallon without the use of large excesses of chemicals. This residual may be reduced to practically zero either by 1) passing the effluent through a sodium-cation exchanger or by 2) second-stage treatment with phosphate.

Regarding deaeration, without the use of an integral deaerator, the primary heater will reduce the dissolved oxygen to less than 0.3 of a milliliter per liter. With the use of an integral deaerator, the dissolved oxygen will be reduced to less than 0.005 of a milliliter per liter.

In the hot lime-soda water softener, the water being treated is sprayed through an atmosphere of low-pressure steam in the upper part of the softener. This heats the water to within a few degrees of the boiling point, drives off the free carbon dioxide, and often some of the half-bound carbon dioxide, and deaerates the water to less than 0.3 ml/liter.

As this hot water falls into the upper level of the water in the softener, it is mixed with measured amounts of the chemicals. At the prevailing high temperature, the chemicals quickly react with the hardness, precipitating it as a quickly settling sludge. The sludge drops to the bottom of the softener, from which it is removed by either periodical or continuous desludging.

If further deaeration is not required, the settled water is then passed through the filters and to service. If complete deaeration is required, the effluent from the filters is passed to the integral deaerator, where all of the steam required for the primary heater is first blown through it thus effecting a very complete deaeration. From the deaerator it then flows to the service pump and from there to the boiler-feed-water line.

DEMINERALIZATION BY ION EXCHANGE——Because of its exceedingly economical operating costs as compared with those of distilled water, demineralization by ion exchange is rapidly coming into extensive use both for special process work and as boiler feed for high-pressure boiler plants. In this process, the cations are removed by a hydrogen-cation exchanger and the anions, by an anion exchanger.

Depending on the amounts of water to be treated, its composition and other requirements, any of several various arrangements of equipment may be used: a) two-step with degasifier, b) two-step without degasifier, c) mixed bed, d) four-step with degasifier and e) hydrogen-cation exchanger and mixed bed with degasifier.

Figure 10 is a flow diagram of the two-

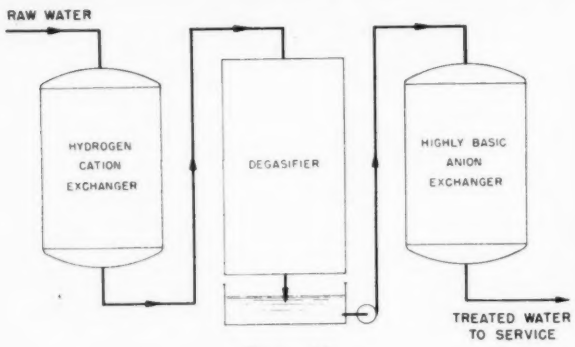


Figure 10
Demineralization by ion exchange, Flow diagram of two-step with degasifier arrangement.
(Courtesy of The Permutit Company)

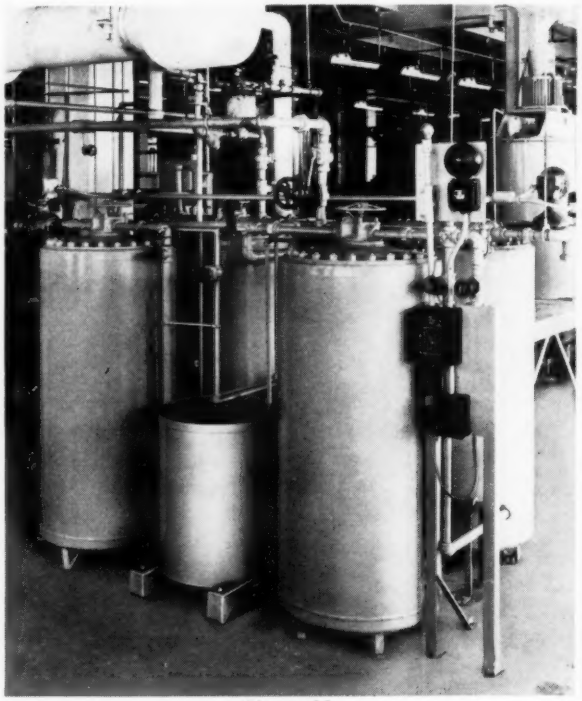


Figure 11
Double unit, two-step without-degasifier demineralization plant.
(Courtesy of The Permutit Company)

step with degasifier (a) arrangement. As shown, the water being treated is first passed through a hydrogen-cation exchanger. This removes calcium, magnesium, sodium, iron and any other cations that may be present, giving in exchange an equivalent amount of hydrogen cations. The effluent therefore contains hydrogen cations and the bicarbonate, sulfate, chloride and silicate anions or, in other words, carbonic, sulfuric, hydrochloric and silicic acids.

As the carbonic acid readily breaks down into free carbon dioxide and water, the cheapest way of removing the carbon dioxide is by aeration in a degasifier. From the degasifier the aerated water is passed through the highly basic anion exchanger, which removes the sulfuric, hydrochloric and silicic (silica) acids as well as any carbon dioxide residual thus furnishing an effluent equal in quality to distilled water. At the end of the demineralizing run the units are cut out of service, backwashed, regenerated, rinsed and returned to service. The regenerant for the cation exchangers is either sulfuric or hydrochloric acid, and caustic soda is the regenerant for the anion exchanger.

In the arrangements of equipment where a degasifier is not included, the carbon dioxide is removed by the anion exchanger. This costs more than removing it by aeration, but, if the bicarbonate content is relatively low and/or the amounts of water being handled are not large, then the simplicity of the equipment may outweigh the higher operating cost. Figure 11 is a photograph of a two-step double unit without degasifier demineralization plant.

The mixed-bed c) demineralization unit is similar in operation to a battery consisting of an extremely large number of alternate hydrogen-cation and anion exchangers, and it produces an extremely high-grade effluent. A more economical arrangement, as far as operating costs are concerned, is the hydrogen-cation exchanger and mixed bed with degasifier arrangement (e). The four-step with degasifier arrangement (d) is a very practical hook up as, in its operation, the last 2 units in the battery (the capacities of which have been used to only a very limited extent) carry the full load while the first 2 units are being regenerated. Then, after the regeneration, the last 2 units in the battery become the first two on the next run.

Ion-exchange demineralization plants are available in a wide range of sizes for all requirements. Installations have been made with a range in capacities from less than 100 to over 40,000,000 gallons per day.

Eight Named to Perkin Centennial Committee

J. ROBERT BONNAR, AATCC president, has appointed a committee of eight to develop plans for the commemoration of the 100th Anniversary of the discovery of the first synthetic dye by Sir William Perkin in 1856. Commemoration ceremonies will be held in conjunction with the 1956 Annual Convention in New York.

The committee includes R W Jacoby, *Chairman;* W D Appel; H F Herrmann; K H Barnard; S L Hayes; M A Dahlen; A E Sampson; and Mr Bonnar.

PTI Student Chapter Meeting Report

AT the May 6 meeting of the Philadelphia Textile Institute Student Chapter, the following officers were elected for the 1953-54 year:

Chairman—Ernest Larrat, Jr

Cochairman—Richard Demuth

Secretary-Treasurer—Gerard M Weiss

Mr Larrat was chairman of the student chapter at the Utica Technical Institute in 1950.

Twenty members were present at the meeting.

Respectfully submitted
GERARD M WEISS, *Secretary*

—♦ ♦—

UTI Student Chapter Meeting Report

AT the March 16th meeting of the Utica Technical Institute Student Chapter, M Twilliger, Skenandoa Rayon Corporation, spoke on the production of rayon. His talk was illustrated with a variety of samples.

Respectfully submitted,
BETSY BEIL, *Secretary*

AATCC Research Bulletin —

A STUDY OF ANOMALOUS FADING IN THE FADE-OMETER*

A Progress Report of a Study of Fading in Testing for Colorfastness of Textiles to Light

By RESEARCH SUBCOMMITTEE ON FASTNESS TO LIGHT
American Association of Textile Chemists and Colorists

INTRODUCTION

MANY laboratories concerned with quality control testing of textiles and dyes use the Fade-Ometer for grading colorfastness to light. It is generally recognized by the users and the manufacturer of this lamp that textiles colored with some dyes receive a lower quality grading in Fade-Ometer tests than in sunlight exposure when tested in comparison with the AATCC blue wool standards. Until relatively recently, this inconsistency, while recognized as undesirable, was not considered outstandingly serious because the majority of these inconsistencies involved dyes that had relatively poor fastness in sunlight tests.

The increasing use of the newer manufactured fibers, and of vat dyes for coloring wool has disclosed more instances of differences between lamp and sunlight gradings. In late 1949, the Executive Committee on Research of the AATCC and the Atlas Electric Devices Company decided to sponsor a study to develop information aimed at improvement of the lamp, with the former contributing a research associate and the latter furnishing the lamps and means for their operation.

Because a study to disclose anomalous lamp fading requires examples of sunlight fading for comparison, it was decided to start this study by making sunlight tests under varying conditions and to use these tests as standards with which to compare the effect of experimental changes in the lamp.

Tests by the AATCC Committee on Colorfastness to Light between 1925 and 1935 with more than 1250 samples of cotton, silk and wool colored with 380 different dyes, demonstrated conclusively, that variations in test conditions that can be controlled, influence fading significantly. *(1)*

TESTS

TESTS MADE IN THE PRESENT STUDY IN SALEM, N J——

1. Samples were stapled to white cotton, to white wool and onto white cardboard. These assemblies were placed on an open mesh plastic screening and on wood. Tests were made under single strength window glass and in direct sunlight; without glass cover.

2. Other similar tests were made in direct sunlight, under single strength window glass and under ⅛" Color Clear plate glass: a glass that transmits shorter wave length light rays than window glass.†

3. Exposures were made in direct sunlight, under single and double strength window glass, under ⅛" and ¼" Color Clear plate glass, and under ¼" automobile safety glass.

4. Exposures were made in direct sunlight and under different glasses including Corex D glass, with the test samples at one, two and three inches from the glass cover.

5. Exposures were made in direct sunlight and under glass in tightly covered cabinets, and in well ventilated cabinets, with the test samples attached to white and to black colored cardboard.

SAMPLES USED FOR TESTS AT SALEM, N J——Sixteen samples of cotton, and 16 of viscose-process rayon colored with substantive dyes and two of wool colored with vat dyes were selected because they fade more rapidly in the Fade-Ometer than in sunlight compared with the AATCC blue wool standards. These tests were made at Salem, N J, between 9 AM and 3 PM, EST during the months of June, July and August of 1950 and 1951.

TESTS AND SAMPLES USED FOR SYNTHETIC SURVEY——During February, March and April 1952 the South Florida Test Service at Miami, Florida, exposed to direct sunlight and to sunlight under single strength window glass 92 dyed samples of cellulose acetate rayon, Acrilan, Dacron, Dynel, nylon, Orlon, cotton, and wool including the AATCC blue wool standards L-3 to L-7 for the separate times required to effect readily perceptible and outstanding fading. These dyed samples were selected for these tests by the AATCC Committee on Colorfastness to Light because they were suspected of being sensitive to variations in temperature and humidity during testing, and known or reported to fade more rapidly in the Fade-Ometer than in sunlight.

After these exposures were completed in Florida they were all examined visually and out of 92 samples, 27 were picked for interlaboratory Fade-Ometer exposures. In this interlaboratory Fade-Ometer survey a record of ambient, room and black panel temperature, and relative humidity in the Fade-Ometer were kept.

The object of this survey was to learn how much of a difference there was between sunlight and Fade-Ometer exposure and also to learn how much under the varying conditions, if they existed, the different Fade-Ometer exposures differed.

METHOD FOR EVALUATION OF THE TESTS——Reflectance measurements on the Hunter color difference meter converted into National Bureau of Standards units of color difference by the formula

$$\Delta E = \sqrt{\frac{2}{\Delta L} + \frac{2}{\Delta a} + \frac{2}{\Delta b}}$$

* This study was under the direction of Charles A Seibert, AATCC Research Associate; Matthew J Babey, Colorist, Calco Chemical Division (Chairman, AATCC Research Sub-Committee on Colorfastness to Light); Joseph E Norton, Director of Research, Atlas Electric Devices Co.

† Spectral transmittance in the ultraviolet region of the glass panels used for these tests are illustrated in Figure 1.

Visual comparisons were made with the use of a Grey Scale which has 5 steps in a geometric scale. Step 5, no change, Step 4, 1.5 NBS unit of color difference, Step 3, 3 NBS units, Step 2, 6 NBS units, Step 1, 12 NBS units.

CONCLUSIONS

While the rate of fading varies in the different conditions of testing, the character of the fading is consistently similar and interchangeable for practical testing purposes.

The meaning of character of fading is that the sample may fade not only in loss of strength (weaker) but also in hue change.

Fading in tightly closed cabinets is, in general, more rapid than in well ventilated cabinets, but not different in character.

In general, the tests demonstrate fading under Corex D and Color Clear glass as just noticeably more rapid than under single strength window glass, but not different in character.

In some instances Hunter meter reflectance measurements of the faded samples indicate small differences in the character of the fading. These are not detectable on visual examination, or not until fading has progressed beyond the quantity normally used for grading, i e, the quantity to produce just appreciable color change.

While most of the samples tested faded more in direct sunlight than under window glass, one or more in each test condition and two of the samples in all test conditions faded more under glass than in direct sunlight; however, the AATCC Blue Wool Standards faded consistently more in direct sunlight than under window glass.

The fugitive and very fast dyes behave very similarly both in the Fade-Ometer and sunlight when exposed under well controlled conditions. However, many of the other dyes show a difference, that is the Fade-Ometer fades faster than sunlight.

In the Fade-Ometer survey when the dyed synthetics were exposed under very high black panel temperatures the samples faded faster and some samples showed a scorching effect.

It is hoped that a table of all these data will be set up in the near future.

WORK PROPOSED FOR THE FUTURE——In identical test cabinets and for identical sunlight hours, during August, September 1952 the AATCC Blue Wool Standards L-2, L-3 and L-4 and Calibration Paper 1554 were exposed in New York City; Bound Brook, New Jersey; Deep Water Point, New Jersey; Lowell, Massachusetts; Washington, D C; Chicago, Illinois; Phoenix, Arizona; Los Angeles, California ;and Portland, Oregon. These tests were made to learn how the fading of an average Fade-Ometer hour compares with an average hour of sunlight fading.

From these exposures enough information was obtained that Atlas Electric Devices Company made up a sturdy, waterproof test box. (Details of test box in "Description of Sunlight Test Cabinet".)

During the coming year these tests will be repeated once every month. It is hoped that from these tests a correlation between sunlight and Fade-Ometer of Blue Light Standards L2, L3 and L4 can be made. Along with the Blue Standards various synthetic fibers will also be exposed. Identical samples will be used for exposure in the new experimental lamp, described in detail under "Description of Experimental Fade-Ometer FO 2710". These exposures in the new lamp will be under varying conditions of humidity and temperature.

DISCUSSION

In the report by Cady and Appel *(2)* on the 1250 samples tested in 1925-1928 they state "The presence or absence of a window glass cover over the samples during exposure in the standard test has practically no effect on the fading of 74% of the samples and only a slight effect on 22% of them. It has a marked effect on the fading of the remaining 4% of the samples". (Standard test is exposure between 9 AM and 3 PM Standard Time, on sunny days between April 1 and October 1.)

Noon June sunlight is reported to include approximately 2% radiation in the region 290-320 mμ and window glass does not transmit below 310 mμ. It is, therefore, important to know whether fading under window glass is sufficiently close to fading in direct sunlight to be acceptable as a test method to predict probable practical performance of colored textiles.

The present tests indicate that while fading under window glass may be slower than in direct sunlight, the character of the fade in both methods is similar, and therefore, these present tests within their limited scope, are in agreement with the conclusions drawn from the earlier test of the AATCC Committee as reported by Appel, Cady, etc, in reference *(3)*.

To have a comparison of fading in direct sunlight with fading under single strength window glass made together and for identical time periods, tests of a large number of dyed natural and manufactured fiber samples were started in Salem, N J, during the summer of 1952. These included military use fabrics of best available fastness and therefore, these tests were not completed, but they will be continued during the summer of 1953.

One objective of these tests is to try to establish a comparative time relation factor for similar fading in direct sunlight and under the window glass. The South Florida Test Service reports this factor in the neighborhood of 8 hours in direct sunlight as being similar to 10 hours under single strength window glass, under their conditions of calculating sun exposure hours. They measure the intensity of the sunlight with the Eppley pyrheliometer and record it with the Leeds Northrup Special Micromax Curve Drawing Recorders and the Brown Recorder with integrating meter and time totalizer. They calculate as exposure time, only the so-called erythema ultraviolet sun hours, i e, when the sun has a minimum intensity of 0.823 gram calories per square centimeter per minute, measured at an angle of 45 degrees from the horizontal, facing south.

AIR TEMPERATURE AT THE SURFACE OF THE TEST SAMPLES——In the tests made at Salem, N J, air temperatures were taken three separate times daily: between 10 and 12 AM, between 1 and 2 PM and between 3 and 4 PM Eastern Standard Time. The differences between the temperatures on the surface of the samples attached to white cotton, to white wool and to white cardboard, with all other conditions uniform, were never found greater than 3°F. In these three different test conditions the temperatures varied between 10° and 40°F higher under glass than in direct sunlight.

With the samples attached to white cotton and to white cardboard, and in both glass and under ⅛" Color Clear glass, the difference in the temperatures under glass were never found greater than 4°F, but as before, under glass they varied between 10° and 40°F, higher than on the surface of the samples exposed in direct sunlight.

With all other test conditions identical, the temperatures in tightly closed cabinets are between 10° and 30°F higher than in well ventilated cabinets. The smaller difference was observed with the ambient air outside the cabinets near 90°F and the greater, with the outside air near 110°F.

Naturally, the objective of the present study is not only to develop, but to utilize this information, and because cabinets in general use for sunlight colorfastness testing vary widely in conditions that may influence fading, the Atlas Company has built a sample cabinet to conform with suggestions by the AATCC Committee on Colorfastness to Light, and others. This cabinet was exhibited at the recent thirty-

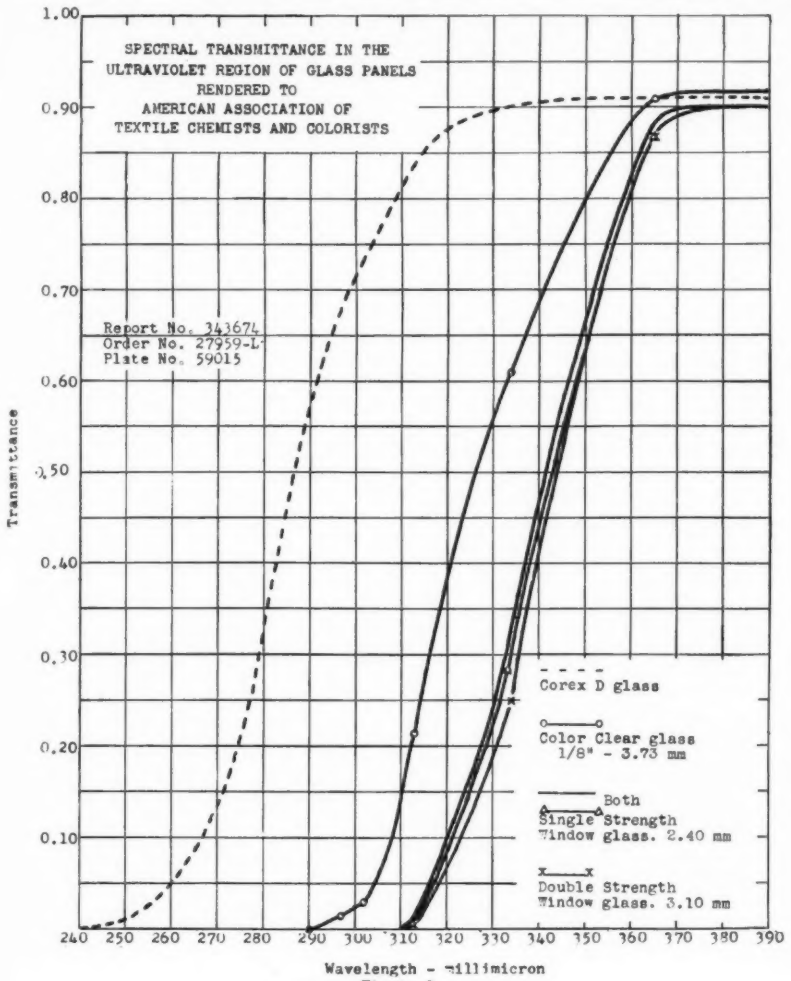


Figure 1

first National Convention in Boston and is illustrated in Figures 2 and 3.

With some major changes suggested as improvements, the Atlas Company plans to build about 20 in the near future. About half of these will be used by the Committee for trial testing and the remainder will be available for general use on purchase. A precise price will be announced when the costs to build the trial lot is known.

FADE-OMETER STUDY DISCUSSION ——Tests and experience have demonstrated that there are several conditions in the lamp that influence fading which must be maintained within some yet undetermined limits to obtain uniformity in fading between lamps and consistent reproducibility in testing. The major of these conditions are: air temperature and humidity, electric energy fed to and physical conditions of the arc, spectral quality and intensity of the light and the distance from the arc and the angle at which the light rays reach the surface of the test samples. Variations in these separate conditions will cause minor variations in one or more of the others.

It is logical to expect that changes in some or all of these conditions now general in the lamp and their control and consistent maintenance wtihin more restricted limits, will improve, and may eliminate, objectionable anomolous fading. The objective of the present study and other studies in progress by the Atlas Company is to learn how to effect the desired improvements.

The Atlas Company constructed for the Philadelphia Quartermaster Research

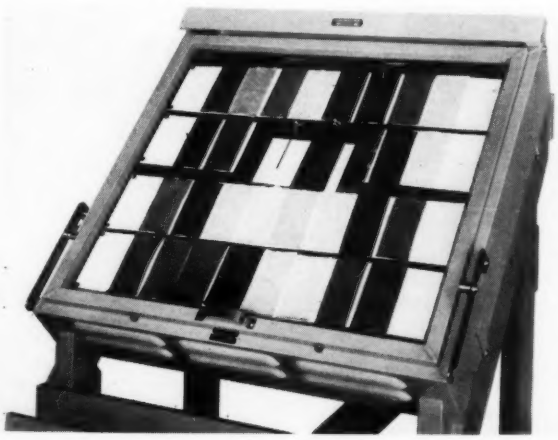


Figure 2

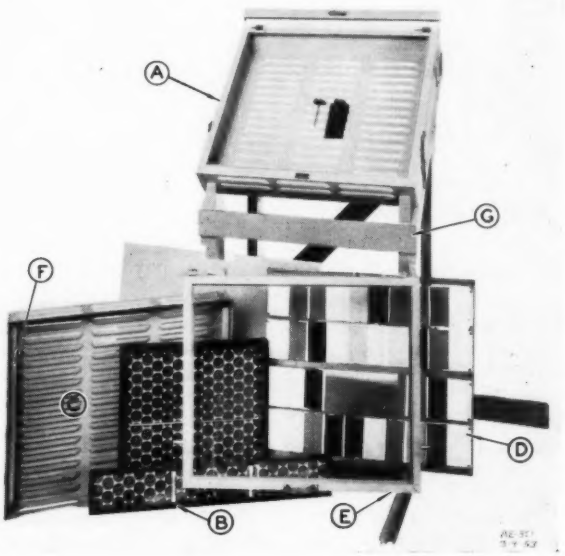


Figure 3 →

Sunlight Test Cabinet

(A) Main support frame
(B) Glass fiber air filters
(C) Inner metal frame
(D) Frame covered with open-mesh screening
(E) Glass cover
(F) Supports
(G) Stand

Figure 4
Front view of experimental Fade-Ometer FO 2710

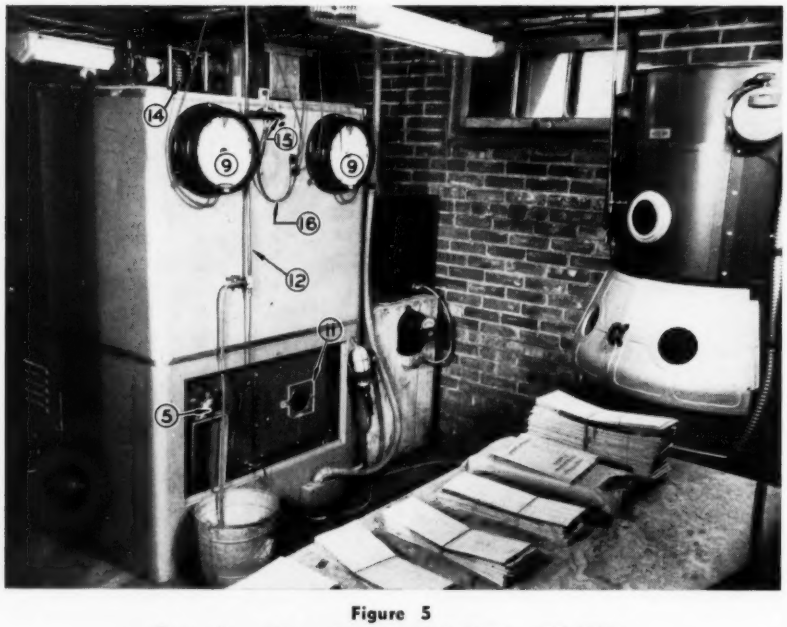


Figure 5
Rear view of experimental Fade-Ometer FO 2710

Laboratories, a Fade-Ometer designed to permit its operation with controlled relatively wide variations in temperature, humidity and electric energy fed the arc, and has furnished the AATCC research associate a similar lamp for experimental studies under the guidance of the AATCC Committee on Colorfastness to Light. The Quartermaster lamp is being used for studies on the colorfastness and aging qualities of plastic films, whereas, the lamp loaned the AATCC will be used for studies on textiles.

These are experimental lamps, not well suited or intended for general testing use. They were designed to develop reliable information on the effect of relatively wide variations in the conditions known to influence fading.

It is the intention of the Atlas Company

Figures 4, 5 and 6

(1) Voltage regulator
(2) Wheelco Capacilog
(3) Control for Walton humidifier
(4) Lamp chamber
(5) Shaft for blower
(6) Flue
(7) Air expelled here
(8) Motor
(9) Foxboro recorders
(10) Vapor pressure bulbs
(11) Cover
(12) Pipe line
(13) Wires
(14) Slip rings
(15) Thermocouple block terminals
(16) Wires
(17) Test sample rack
(18) Thermocouple wires
(19) Black panel thermometer wires
(20) White cotton wires
(21) White viscose rayon wires
(22) White wool wires
(23) AATCC blue wool standard L-4 wires
(24) Terminal block

to make available to Fade-Ometer users the means to effect improvements in their lamps now in use at the same time, or before, they are included in newly built lamps.

The experimental lamp, designated FO-2710, is illustrated in Figures 4, 5 and 6. Figure 4 is a general view of the front, Figure 5 of the back and Figure 6 of the control panel and thermocouple facilities. A detailed description of the lamp is also included.

BLACK PANEL THERMOMETER—— In a co-operative study by a task group of the Society of the Plastics Industry, some plastic films became outstandingly yellow and brittle on relatively short exposure in the Fade-Ometer and it was quickly established that this tendency varied with variations in temperature. However, it was observed that the degree of yellowing and brittling varied much more than was logical to expect from relatively small variations in temperature as indicated by mercury bulb and bimetallic dial type thermometers with their bare bulbs exposed to the radiation while located on the specimen rack so that the sensitive portion of these thermometers was unprotected and at the same location as the center of the face of the test specimens.

It was also observed that these thermometers were less sensitive to temperature variations than the thermostat that controls the operation of the air circulating fan in the FDA-R Fade-Ometer.

This led the Atlas Company to make available what is known as a Black Panel Thermometer. This device, illustrated in Figures 2 and 3, is a stainless steel panel 0.032 inches in thickness with approximately 100 sq cm of surface on which is

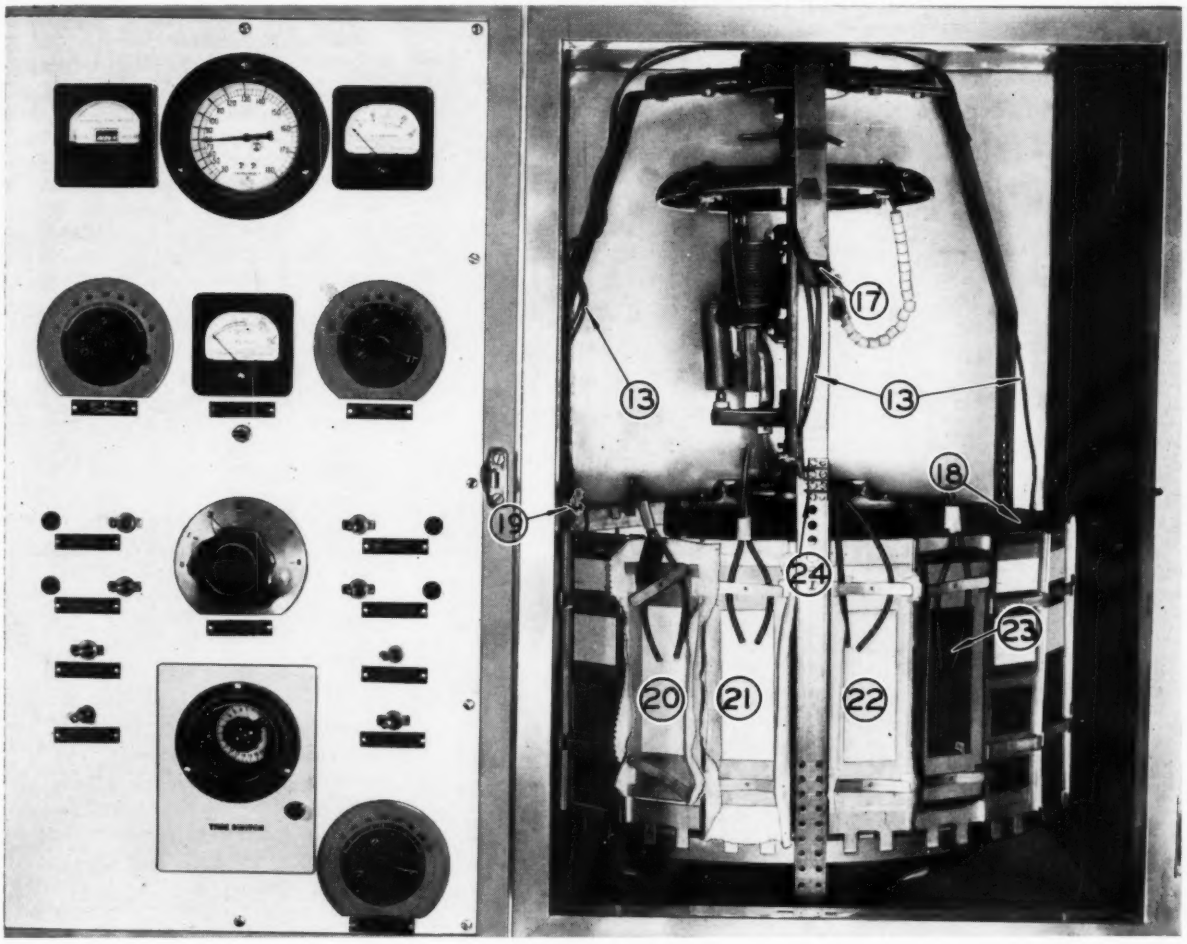


Figure 6
Control panel and thermocouple facilities of Experimental Fade-Ometer FO 2710

mechanically fastened a bimetallic dial type thermometer with the entire surface covered with two coats of black baking enamel.

Theoretically, the black panel has a maximum absorption of all of the radiation from the lamp and provides a more accurate indication of test sample surface temperatures. In the Fade-Ometer it indicates temperatures 80 to 100 degrees, and in sunlight tests, as much as 40 degrees F higher than the other thermometers mentioned.

The technical committee of the Society of the Plastics Industry concerned with the use of the Fade-Ometer and weathering lamps for testing the aging qualities and colorfastness to light of film, have tentatively agreed to use the Black Panel Thermometer for temperature control and records.

TESTS IN THE EXPERIMENTAL LAMP——The lamp appears excellently suitable for its intended use.

Some indication of what tests in the lamp will reveal are illustrated by Figures 7 and 8. Figure 7 illustrates the temperature variations obtained in different fabrics exposed at the same time under identical test conditions. The temperature of 95°F for the AATCC Blue Wool Standard L-4; 125°F for similar quality undyed wool; 130°F for undyed viscose process rayon and 133°F for undyed cotton were recorded as the samples were rotated around the arc with the air temperature at their surface between 105-110°F.

Figure 8 illustrates by numerical values (National Bureau of Standards units of color difference) variations in the comparative amount of fading on five colored samples produced by variations in temperatures and humidity. The units of color differences of fading in these tables are probably only accurate within 10%, but they do illustrate that fading is influenced by variations in conditions that can be controlled and maintained relatively constant, and also that variations in these conditions do not have the same influence on the fading of all colored samples.

Recently visiting representatives of European technical associations asked why the American Textile Industry uses the Fade-Ometer when it is known that its results are not always reliable. The answer was that they produce reliable indications of practical performance qualities on between 88 and 90% of the textile samples tested in them and that the dyes that do not fade in the lamp in satisfactory agreement with sunlight fading, are well known to their manufacturers. Also, the Fade-Ometer can be used at will and for at least 20 hours daily, whereas, in Miami, Florida, sunlight of an intensity useful for test fading, averages about 4 hours daily for the entire year.

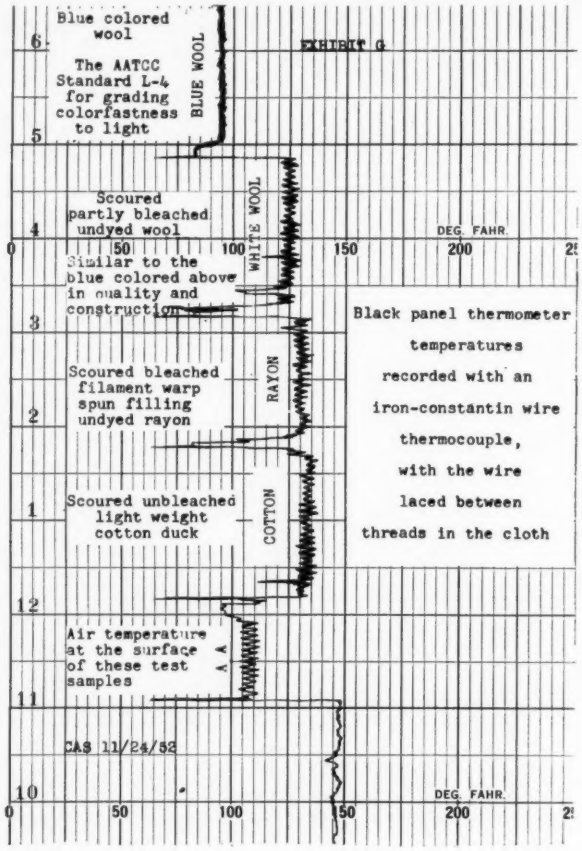

Blue colored wool
The AATCC Standard L-4 for grading colorfastness to light
BLUE WOOL
EXHIBIT G
Scoured partly bleached undyed wool
WHITE WOOL
DEG. FAHR.
Similar to the blue colored above in quality and construction
Black panel thermometer temperatures recorded with an iron-constantin wire thermocouple, with the wire laced between threads in the cloth
Scoured bleached filament warp spun filling undyed rayon
RAYON
Scoured unbleached light weight cotton duck
COTTON
Air temperature at the surface of these test samples
CAS 11/24/52
DEG. FAHR.

Figure 7

The glass cover is single strength, flat drawn sheet window glass that has the transmittance qualities illustrated in Figure 1.

The Color Clear, Corex "D", and other glasses that transmit shorter wave length light rays than the window glass, are not available in the size and/or quantity to serve practical testing requirements.

The outside dimensions of the cabinet are approximately 30 x 32 x 6 inches; the useful testing surface area approximately 22 x 26 inches; and the weight close to 52 pounds of which the glass cover weighs a third.

The Exposure Cabinet will be supplied with a stand (G), or may be purchased without stand for those who wish to construct their own because of preferred height and other physical conditions.

DETAILED DESCRIPTION OF EXPERIMENTAL FADE-OMETER FO 2710

In Figure 4, instrument (1) is a voltage regulator that permits a wide range variation in the quantity fed the arc and consistent maintenance of that quantity within ± one volt. Instrument (2) is a Wheelco Capacilog that records temperatures within the lamp by means of connected thermocouples. (3) is the control for the volume of atomized water released into the lamp chamber (4) by the Walton humidifier.

REFERENCES

(1) Available from the Secretary of the AATCC. Report of the AATCC Subcommittee on Light Fastness: Light Exposures, Series 3 and 4: in 3 sections.
(2) Reference (1) Section 3, page 3.
(3) Reference (1) Section 2, page 13.

DETAILED DESCRIPTION OF SUNLIGHT TEST CABINET

The cabinet consists of 5 main parts: (A), the main support frame or outer shell of grey enameled louvered metal; (B), glass fiber air filters; (C), another grey enameled louvered metal frame or inner shell that sets inside (A), with the louvers opening toward the upper side of, and in the opposite direction to those in (A), the main support frame. (D), a frame covered with open mesh screening on which the test samples lie, and (E), the glass cover.

On the left and right sides of the insert frame (C), are metal supports (F). The open mesh screen frame (D) rests on the supports (F), which can be raised and lowered to have the test samples between 1 and 3 inches from the glass cover.

TESTS IN EXPERIMENTAL FADE-OMETER FO-2710 BY THE ATLAS ELECTRIC DEVICES COMPANY, INC

Test Number	Black Panel Thermometer Temperature °F	Percentage Relative Humidity	National Bureau of Standards (Judd) Units of Color Difference Fading: AATCC Blue Wool Standard L-3	AATCC Blue Wool Standard L-4	Red Dacron	Yellow Dacron	Calibration Paper 1554
COMPARING EFFECT OF TEMPERATURE VARIATIONS							
1513	135	20	4.85	2.22	5.90	1.52	14.6
1519	150	20	5.10	2.47	11.20	2.16	15.8
1517	165	20	5.60	2.70	10.70	2.36	21.2
1522	180	20	5.50	2.53	16.00	2.04	17.6
1514	135	40	5.20	2.32	5.40	2.00	17.4
1511	150	40	5.40	2.47	10.50	1.90	17.6
1523	165	40	5.60	2.85	9.80	1.78	22.2
1516	135	60	5.05	2.46	7.60	1.40	15.9
1520	150	60	5.35	2.24	11.40	1.63	17.4
1521	165	60	5.50	2.55	11.00	2.22	17.3
COMPARING EFFECT OF RELATIVE HUMIDITY VARIATIONS							
1513	135	20	4.85	2.22	5.90	1.52	14.6
1514	135	40	5.20	2.32	5.40	2.00	17.4
1516	135	60	5.05	2.46	7.60	1.40	15.9
1519	150	20	5.10	2.47	11.20	2.16	15.8
1528	150	40	4.80	2.28	7.70	1.46	15.7
1520	150	60	5.35	2.24	11.40	1.63	17.4
1517	165	20	5.60	2.70	10.70	2.36	21.2
1523	165	40	5.60	2.85	9.80	1.78	22.2
1521	165	60	5.50	2.55	11.00	2.22	17.3

SAMPLES USED FOR THE TESTS
AATCC Blue Wool Standards L-3 and L-4 for grading Colorfastness to Light.
Dacron colored with 1% Celanthrene Red 3BN Conc
Dacron colored with 1% Acetamine Yellow N
National Bureau of Standards Blue Fade-Ometer Calibration Paper No 1554
TEST TIME: 20 Clock Hours

Figure 8

The air is circulated within the lamp chamber (4) by means of a squirrel cage type blower attached to shaft (5) in the chamber directly below. The volume of air circulated can be varied by changing the size of the pulleys on shaft (5) and the motor that supplies the power, situated directly below. The air is drawn into the lamp chamber (4) through a flue at (6) covered with a glass fiber filter and expelled above the left side of the lamp at (7). This is accomplished by a four-way mixing valve operated by a thermostatically controlled two-directional modulating motor (8).

In Figure 5, the back of the lamp, are Foxboro recorders (9) of wet and dry temperatures relayed from their remote vapor pressure bulbs located at (10), to the left in the lamp chamber (4), Figure 4. On the floor, behind the cover (11) is located the Walton centrifugal type humidifier. The water is fed this humidifier and the wet bulb thermometers within the lamp through pipe line (12).

On the control panel of Figure 6, from the upper left hand corner down are: running time meter for recording the total hours the lamp has operated, air temperature regulator,* switch for electric heaters used in the control of the air temperature, switch for electric immersion heaters used in the water bath feeding the Walton humidifier, switch for the arc lamp and a switch not presently in use. In the center row are: remote bulb thermometer indicating the temperature of the air as it is exhausted from the test chamber, arc and line voltmeter, reactance transformer control switch, time switch to operate the lamp for any desired number of hours that are less than 24 or that a trim of carbons will serve. In the right hand row are: ammeter for arc lamp, humidity regulator,* on and off switch for main line electric current, on and off switch for electric current to Walton humidifier, arc lamp resistance control switch, switch for specimen rack drive motor, regulator for temperature of water bath feeding the Walton humidifier.

In Figure 6, in the lamp chamber, are wires (13) that run through the top of the lamp to slip rings (14) on Figure 4 and 5 and through metal brushes which are connected to thermocouple block terminals (15) on Figure 5. Through wires (16) these connect with the Wheelco Capacilog (2) on Figure 4 and record temperatures within the lamp.

Wires (13) are fastened to the supports of the test sample rack at (17) and revolve with the test samples around the arc continuously and therefore, the temperatures recorded are acceptably reliable.

Wires (13) can be connected to indicate temperatures at any point on the test sample revolving rack, including indications of internal temperature of test samples. In Figure 6, thermocouple wires (18) are connected to a bimetallic thermometer which registers the ambient air temperature at the face of the specimen. Wires (19) are connected to a black panel thermometer, wires (20) to white cotton, (21) to white viscose rayon, (22) to white wool and (23) to the AATCC blue wool standard L-4.

The ambient air (18) and black panel (19) thermocouples are connected with one of the three separate pairs of thermocouple lead wires in terminal block (15) Figure 5. The third pair is connected with terminal block (24) Figure 6, and temperatures of test samples (20), (21), (22), and (23) are recorded by connecting wires from them to this terminal block.

*These function through remote bulbs located in the chamber with the squirrel cage blower immediately below the glass enclosed arc, and under a series of circular metal baffles to aid uniform distribution of the air from the blower.

3rd Annual Management Meeting, R I Section

April 24, 1953

AT THE Third Annual Management Meeting of the Rhode Island Section on April 24, 1953 at Wannamoisett Country Club, Rumford, R I, J Whitney MacDonald, General Manager of Rumford Chemical Works gave a paper entitled "Rhode Island Industry Looks Ahead—Or Does It?" John F O'Sullivan of the East Providence Sewer Commission followed with a paper entitled "Industrial Waste Treatment."

The meeting and dinner attracted approximately one hundred seventy-five.

Respectfully submitted,

ROBERT G THOMAS, *Secretary*

(Photo by Kenneth C Everett)

Harry F Clapham (left), Dye and Chemical Division, E I du Pont de Nemours & Co, Inc and Robert Farwell, also of Du Pont, discuss matters at the March 27th meeting of the Rhode Island Section. Mr Clapham at the meeting presented a paper, "The New Neutral Dyeing Colors for Wool".

(Photo by Kenneth C Everett)

At the same meeting, Raymond Jacoby (left) and Chester Kopatch, Ciba Co, Inc are shown in a huddle with Arthur McLean, Glenlyon Print Works, R I Section Vice-Chairman (third from left) and Harvey J Sarles, G H Walker & Co (extreme right). Mr Sarles followed Mr Clapham on the program with a discussion of "The Rhode Island Development Company".

Pacific Southwest Section Meeting Report

April 24, 1953
Nikabob Cafe, Los Angeles, Calif

THE Pacific Southwest Section held a quarterly meeting on April 24, 1953 at the Nikabob Cafe in Los Angeles.

Robert Mishell, Dyemasters, Inc, Russell Coleman, National Dyeing and Finishing Corp, and Robert Butler, Dyecraft Corp, gave talks on the past, present and future of yarns, cotton materials and synthetic fabrics, respectively.

The minutes of the previous meeting were read by Angus Roberts, Secretary, after which Fred Haselhorst, Treasurer, gave a financial report. Robert Butler, Section Chairman, presented the following newly elected officers of the section to the thirty-nine members and guests present:

Chairman —— Sidney Springer, Sidney Springer Company

Vice Chairman —— Robert Roth, Hess-Goldsmith, Inc.

Secretary——Clarice Lindsey, University of California

Treasurer——Sergio Dadone, Los Angeles Piece Dye Works

Councilor —— Angus Roberts, Jacques Wolf & Co.

Sectional Committee: J Nehmens, Du Pont Co.; Harry Smith, Standard Dyers; Frank Donyes, Hess-Goldsmith, Inc; Henry Salomon, United Piece Dye Works.

Mr Springer appointed several committees and presented plans for increasing attendance and membership. A vigorous discussion on the points suggested was held by the assembly.

Respectfully submitted,
ANGUS H ROBERTS, *Secretary*

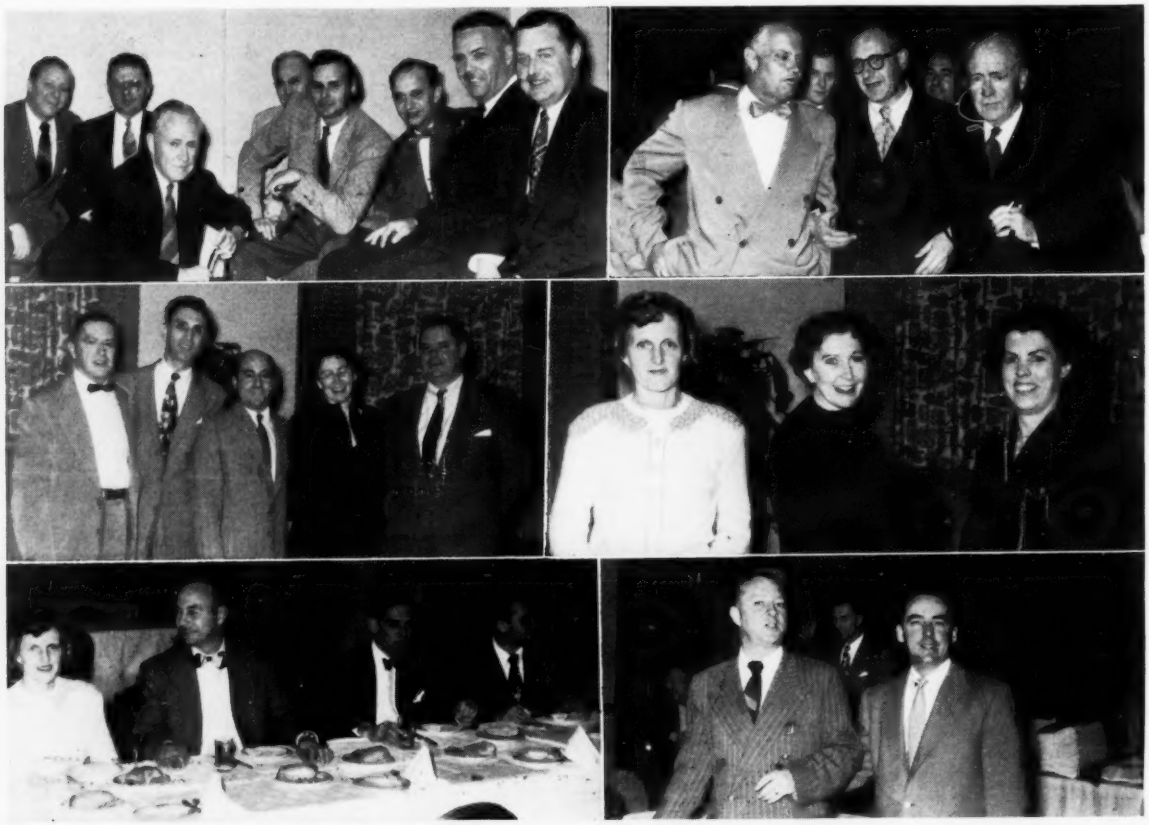
Southeastern Section Meeting in Atlanta Attracts Large Group

APPROXIMATELY one hundred members were in attendance on April 18 for the afternoon and evening sessions as the Southeastern Section met at the Biltmore Hotel, Atlanta, Ga.

The afternoon session featured talks by Nesbit Johnston, Geigy Co, Inc on "Practical Application of Organic Sequestering Agents" and Walter Carter, Chemstrand Corp, on "Homogenizing of Starches".

Following dinner, those in attendance enjoyed a movie, "June Errand," which was presented by Paul Seydel, Seydel-Woolley & Co.

MEETING OF THE PACIFIC SOUTHWEST SECTION—APR. 24, 1953—LOS ANGELES



Upper Left (l to r): E Lindquist, F Wilhelm, D Driscoll, R True, T Smock, R Nehmens, W Ingram, L Olsen

Center left (l to r): A H Roberts, Jacques Wolf & Co; S Springer, S Dadone, Los Angeles Piece Dye Works; C Lindsey, R Roth, Hess-Goldsmith

Lower left (l to r): H Wright, Kelco Co; R Andersen and R Cernik, Peerless Laundries; J Smith, Dyemasters Inc

Upper right (l to r): unidentified; unidentified; D F Driscoll, Sandoz Chemical Works, Inc

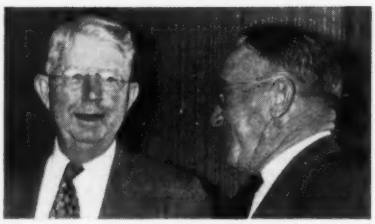
Center right (l to r): H Wright, Kelco Co; C Lindsey and S Walker, UCLA

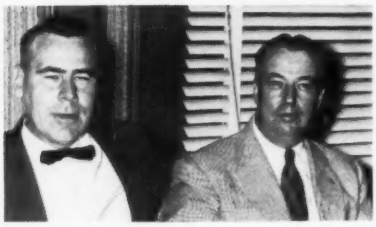
Lower right (l to r): E Lindquist, Geigy Co, Inc; P Noonan, National Dyeing & Finishing Co

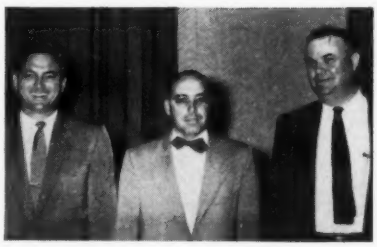
MEETING OF THE SOUTHEASTERN SECTION

APRIL 18, 1953

Biltmore Hotel, Atlanta, Ga.







Report of Western New England Section Ladies Night Meeting

A MOST successful "Ladies Night" meeting of the Western New England Section was held in the Saratoga Room of the Waverly Inn, Chesire, Connecticut, on May 8, 1953.

The technical program consisted of a talk by Donald H Powers, Warner-Hudnut Company, on "The Chemistry of Modern Cosmetics".

A colorful sound picture entitled "Tournament of Roses" followed Dr Powers' talk.

Approximately 110 members and guests were present.

Respectfully submitted,
NATHANIEL J GLADE
Secretary

d guests

nitted,
GLADE

1953